Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/EP05/001541

International filing date: 11 February 2005 (11.02.2005)

Document type: Certified copy of priority document

Document details: Country/Office: EP
Number: 04076206.4
Filing date: 21 April 2004 (21.04.2004)

Date of receipt at the International Bureau: 17 March 2005 (17.03.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

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Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

04076206.4

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

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Anmeldung Nr:
Application no.: 04076206.4
Demande no:

Anmeldetag:
Date of filing: 21.04.04
Date de dépôt:

Anmelder/Applicant(s)/Demandeur(s):

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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se referer à la description.)

Dispensing of a substance II

In Anspruch genommene Priorität(en) / Priority(ies) claimed /Priorité(s) revendiquée(s)
Staat/Tag/Aktenzeichen/State/Date/File no./Pays/Date/Numéro de dépôt:

EP/18.04.04/EP 04075524

Internationale Patentklassifikation/International Patent Classification/
Classification internationale des brevets:

A47J31/40

Am Anmeldetag benannte Vertragstaaten/Contracting states designated at date of filing/Etats contractants désignées lors du dépôt:

AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL
PL PT RO SE SI SK TR LI

Dispensing of a substance II

The present invention relates to dispensing of a substance from a container by means of a dispensing apparatus.

This is for example known from EP 278 773, where a beverage dispensing apparatus is shown. The dispensing apparatus is adapted to empty a bag containing a flavouring constituent for the preparation of a carbonated beverage. The bag is inserted into a receiving and actuating unit, which has means to compress the bag and expel the content out of it into a discharge nozzle. The discharge nozzle is also connected to a feed conduit for feeding carbonated water. The feed conduit is provided with a closing valve which can be opened by operating a lever by pressing a serving cup against it. The flavouring constituent and the carbonated water are thus mixed in the discharge nozzle before they are dispensed in the serving cup. When different bags with different flavours are inserted subsequently in the receiving unit, a cross contamination between different flavours can occur. Next to the part for serving carbonated drinks the known dispensing apparatus has also separate spigots for hot water and cold water.

The present invention proposes to dispense a substance from a container filled with a single portion of a substance. The container comprises a deformable body, preferably made of sheet material, defining a filling cavity which body has an opening and an integral planar circumferential rim surrounding said opening, which opening is closed by a cover sheet of foil material which is sealed to the circumferential rim by means of a circumferential sealing seam.

Such a container as such is known. For example EP 299 571 shows a container for a small quantity of milk, cream or the like. The container has a bottom and a wall of rigid plastic defining a filling cavity. Further, the container is provided with a channel which is in communication with the filling cavity. A cover sheet covers the filing cavity and the channel. The cover sheet has a pulling tab by means of which it can be pulled away at the channel for forming an opening through which the content of the container can be dispensed.

According to the invention the substance, e.g. syrup for a soft drink is dispensed directly from the container into a serving cup or a bottle. Also the water is dispensed into the cup such that mixing takes place in the cup thereby preventing the contamination of the dispensing apparatus with the substance.

The invention proposes to open the container with the substance by making use of the deformability of the cover sheet. The container is held in receiving means and the cover sheet is engaged with a support surface provided with a recess. The support surface supports the cover sheet except at the position of the recess. The recess is positioned at least over a part of the circumferential sealing seam. Then the container body is compressed whereby the substance is pressurized and the cover sheet bulges out into the recess such that the sealing seam is broken at the location where the bulge is formed resulting in the container being open. This way of opening the container requires no cutting means or other means adapted to open the container that could get contaminated with the substance, which is advantageous in view of hygiene.

Preferably the container is manufactured by a vacuum or thermo forming process. A flat sheet, preferably of plastic or aluminium, is placed in a vacuum or thermo forming apparatus with a forming die and multiple container bodies are formed simultaneously in the sheet by vacuum forming the filling cavities into the die. Then the sheet with the filling cavity is placed in a filling machine and filled with substance. The sheet with the container bodies is covered by a sheet of covering foil that is sealed over it. Finally, the sheet with the closed containers is placed in a punch machine, where the perimeter of the circumferential rim of the body is formed by punching out waste material between the containers.

Preferably the sheet of covering foil is manufactured of aluminium or another material, preferably a multilayer material. In an advantageous embodiment the covering sheet is provided with identification means. The identification means correspond to the substance contained in the container so as to allow automatic identification of the container. This container can be placed in a dispensing apparatus comprising identification recognition means for automatically identifying the container and the substance therein.

The invention will become more apparent from the following description with reference to the drawing, in which:

Fig. 1 shows a view in perspective of a preferred embodiment of a container according to the invention,

Fig. 2a shows a front view of the container of Fig. 1,

Fig. 2b shows a top view of the container of Fig. 1,

Fig. 2c shows a side view of the container of Fig. 1,

Fig. 3 shows a view in perspective of the container of Fig. 1 in a compressed state,

Fig. 4a shows a front view of the container of Fig. 3,

Fig. 4b shows a top view of the container of Fig. 3,

Fig. 4c shows a side view of the container of Fig. 3,

Fig. 5 shows a perspective front view of an embodiment of a drink dispensing apparatus with receiving means for the container of Fig. 1,

Fig. 6 shows a perspective front view of another embodiment of a drink dispensing apparatus with receiving means for the container of Fig. 1,

Fig. 7 is a schematic cross section of the dispensing apparatus of Fig. 6,

Fig. 8 shows a perspective front view of the dispensing apparatus of Fig. 6 with an opened lid of the receiving means,

Fig. 9 shows how the container of Fig. 1 is inserted in the dispensing apparatus of Fig. 6,

Fig. 10 shows the container of Fig. 1 is in the full inserted state in the dispensing apparatus of Fig. 6,

Fig. 11 shows how the compressed container of Fig. 3 is removed from the dispensing apparatus of Fig. 6,

Fig. 12 shows an alternative embodiment of a container,

Fig. 13 shows another alternative embodiment of a container,

Fig. 14a shows a further embodiment of a container with a dispensing channel with a closed end,

Fig. 14b shows a detail of the container of Fig. 14a,

Fig. 14c shows the dispensing channel of the container of Fig. 14a after the channel has been opened,

Fig. 15 shows a top view of an alternative embodiment of a container,

Fig. 15a shows part of the top of another alternative embodiment of a container,

Fig. 15b shows part of the top of still another embodiment of a container,

Fig. 15c shows an alternative embodiment of a covering lid for a dispensing apparatus which can be used with containers of Figs. 15, 15a and 15b,

Fig. 15d shows how the container of Fig. 15a or 15b is compressed and its content is mixed with a mixing fluid,

Fig. 16 shows a perspective view of an embodiment of a container with two filling cavities,

Fig. 17 shows a cross section of a container with two filling cavities with different heights,

Fig. 18 shows a top view of the container of Fig. 16,

Fig. 19 shows a top view of a container with two filling cavities with each a different cross section,

Fig. 20 shows a cross section of an embodiment of the receiving means provided with heating elements,

Fig.21a shows a cross section of an embodiment of the receiving means with a certain piston form before compression of the container,

Fig. 21b shows the cross section of the receiving means of Fig. 21a after compression of the container,

Fig.22a shows a cross section of an embodiment of the receiving means with another piston form before compression of the container,

Fig. 22b shows the cross section of the receiving means of Fig. 22a after compression of the container,

Fig. 23a shows a perspective view of the dispensing apparatus of Fig. 6 with a bottle placed in it,

Fig. 23b shows a front view of the dispensing apparatus of Fig. 23b,

Fig. 24 shows a cross section of an embodiment of the receiving means with yet another piston form before compression of the container,

Figs. 25a and 25b show a perspective view and a cross section respectively of a preferred embodiment of the receiving means in a first state,

Figs. 26a and 26b show a perspective view and a cross section respectively of a preferred embodiment of the receiving means in a second state,

Figs. 27a and 27b show a perspective view and a cross section respectively of a preferred embodiment of the receiving means in a third state,

Figs. 28a and 28b show a perspective view and a cross section respectively of a preferred embodiment of the receiving means in a fourth state,

Figs. 29a and 29b show a perspective view and a cross section respectively of a preferred embodiment of the receiving means in a fifth state,

Figs. 30a and 30b show a perspective view and a cross section respectively of a preferred embodiment of the receiving means in a sixth state,

Figs. 31a and 31b show a perspective view and a cross section respectively of a preferred embodiment of the receiving means in a seventh state,

Fig. 32 shows a perspective view of a preferred embodiment of a container that can be used with the receiving means of Figs. 25-31,

Fig. 33 shows a top view of an alternative embodiment of a container,

Figs. 34a-d show a preferred embodiment of a bottle that can be used in the dispensing apparatus of the invention,

Figs. 35a-e show steps of the connecting of a CO2 bottle with a connecting arrangement, and

Fig. 36 shows in more detail a part of Fig. 35d.

Figs. 1, 2a-2c show a container 1 for containing a substance. The container 1 comprises a deformable body preferably made of plastic sheet material. The body can also be made of another material, e.g. aluminium or laminated cardboard paper. Preferably the body has a bottom 3 and a side wall 4 extending from the bottom 3, which define a filling cavity. On the side opposite the bottom 3 a planar circumferential rim 5 is integral with the side wall 4 and extends outwardly therefrom. The circumferential rim 5 surrounds an opening 6. A cover sheet 7 of foil material is sealed to the circumferential rim 5 by means of a circumferential sealing seam 10

and closes the opening 6. The foil material can be a multilayer material.

In Fig. 2b is shown a top view of the container 1 without the cover sheet. The circumferential rim 5 has an extending tab 8 with a dispensing channel 9 formed by a depression in the tab 8. Further, the circumferential rim has a gripping tab 11 diametrically opposite the extending tab 8. The cover sheet 7 is also sealed to the extending tab 8 and preferably also to the gripping tab 11.

The dispensing channel 9 has an open end 9a at the edge of the extending tab 8. The extending tab 8 with the channel 9 is covered by the cover sheet 7. As can be seen in figs. 2b and 2c, the dispensing channel 9 is separate of the filling cavity, that is, it does not join the filling cavity. When the filling cavity is filled with substance and the covering sheet is applied to the container, zone 10b of sealing seam 10 near the dispensing channel 9 forms a barrier for the substance between the cavity and the dispensing channel 9.

Preferably, the zone 10b of the circumferential sealing seam 10 at the location of the dispensing channel 9 is weakened. This can be done by giving the sealing seam 10 a smaller width near the dispensing channel 9 than at the rest of the circumference (see Fig. 2b). Another possibility is to heat the sealing seam 10 locally near the dispensing channel 9, such that it is weakened locally.

When in use the container body can be compressed, thereby pressurizing the content of the container 1. By the increasing pressure on the inside of the container 1, the sealing seam 10 breaks at that zone 10b and a passage is formed between the cover sheet 7 and the area of the tab surface that connects the filling cavity with the dispensing channel, so as to allow substance to pass through the passage from the cavity into the channel 9. This is illustrated with arrows 90 in Fig. 2b.

Figs. 6-8 show a drink dispensing apparatus 61 with a housing 62. On top of the housing 62 is placed a water tank 63, for feeding water. In another embodiment it is also possible to provide the apparatus with an internal water storage tank. It is also possible to connect the apparatus to a water supply line. From the housing 62 is extending a platform 65 for placing a cup 64 on which is to be filled with a drink. Above the cup 64 are arranged three dispensing pipes 66a, 66b and 66c, through which can be dispensed cold water, warm

water and carbonated water respectively. At the underside a platform 70 is arranged. The platform 70 can be formed as a grid with a collecting receptacle 71 underneath for collecting spilled water. The collecting receptacle 71 can be removable so that it can be cleaned. In a further embodiment an evaporator can be arranged in the collection receptacle to evaporate spilled fluid, such that the receptacle does not have to be emptied too often.

It is also possible to place bottles or glasses and the like in the apparatus. The bottle can be placed on the platform 70. In Fig. 23a and 23b the dispensing apparatus 61 is shown with a specially designed bottle 230 in it. The bottle 230 has a top part 231 which is adapted to fit in a sealing manner under the receiving means 67 such that dispensed substrate and water cannot be spilled during dispension. To that end the receiving means 67 can be provided with sealing means like a sealing gasket or the like.

In Figs. 34a-d a further embodiment of a bottle 430 for the dispensing apparatus 61 is shown. In this embodiment the bottle 430 has a plug-like closing member 431. Around the bottle neck a rotatable ring 433 is arranged. In the ring 433 are provided two slots 434 that extend helically through the ring 433. On the ring 433 is provided a gripping fin 436.

The closing member 431 is coupled to the ring 433 by a bracket 432 with two legs 432a en 432b. Each leg 432a, 432b has a protrusion 435 that extends inwardly and are each inserted in one of the slots 434. In each of the legs 432a and 432b of the bracket 432 is provided a guiding slot 437 comprising an upper straight slot portion 437a and a lower curved portion 437b. On the bottle neck are on diametrically opposite sides provided guiding pins 438 which each are received in one of the guiding slots 437.

In use the bottle is closed by the closing member 431 as is shown in Fig. 34a. A person can open the bottle 430 by gripping the gripping fin 436 and rotating the ring 433. By this rotation the helical form of the slots 434 force the protrusions 435 on the brackety legs 432a and 432b upwards as can be seen in Fig. 34b. The covering member 431 is thus lifted from the bottle 430 guided by the guiding pins 438 in the straight portions 437a of the guiding slots 437.

At a certain point the bracket 432 is lifted such a distance that the curved portions 437b of the guiding slots 437 reach the guiding pins 438. By rotating the ring 433 further the bracket 432 will start to tilt due to the cooperation of the guiding pins 438 and the curved portions 437b of the guiding slots as can be seen from Fig. 34c. The closing member 431 is tilted away from the bottle 430 until the end position is reached, i.e. the position in which the curved portions 437b of the guiding slots 437 engage the guiding pins 438 as is shown in Fig. 34d. In the state shown in Fig. 34d the user can place the bottle in the dispensing apparatus to fill it or can poor drinks from the bottle 430.

For closing of the bottle 430 the ring 433 is rotated in the opposite direction and the opposite sequence as described with reference to Figs. 34a-d is followed.

The dispensing apparatus comprises receiving means 67 for receiving a container 1 as is described hereabove, filled with a single portion of a substance, e.g. coffee concentrate or syrup for a soft drink.

In Fig. 7 is shown a schematic cross section of the apparatus 61. The water from the tank 63 can be directed by means of a control system 75 through feed lines 74a to a cooling system 73, a heating system 72 and a carbonating system 71, which are connected with the three dispensing pipes 66a, 66b and 66c respectively by feed lines 74b. The carbonating system 71 preferably comprises a bottle filled with CO2 which will be described below.

It is also possible to have four lines 51-54 that are all connected to one central dispensing pipe 50 as is shown in Fig. 5. The dispensing pipe 50 is directed such that the water is ejected in the beam of substance that is dispensed from the container 1, such that a good mixing between the two is secured. The four lines 51-54 are for feeding hot water, cooled water, water with an ambient temperature and carbonated water to the dispensing pipe 50.

In Fig. 35a is shown how a CO2 bottle 360 is positioned under a valve arrangement 351.

The CO2 bottle 360 is provided with a closing valve 361. The closing valve 361 has a housing 366 with an outlet 362 which is closed of by a preferably spring loaded closing member 363 that has to be pushed down such that the outlet 362 is opened. On the upper

side of the valve housing 366 is provided a circumferential flange 367 with two straight edges 367a.

The connecting arrangement 351 comprises a substantially cylindrical housing 352. Within the housing 352 a connecting means 354 is slideably arranged. The connecting means 354 can slide between a released position and a connected position within the housing 352. In Figs. 35a-c the connecting means 354 is in the released position in Figs. 35d, 35e and 36 the connecting means 354 is in the connected position.

The connecting means 354 has an outlet 355 to which a pipe or a hose can be connected. The connecting means 354 fits on the closing valve 361 on the CO2 bottle 350 and comprises a protruding member (not shown) which is suitable for pushing down the closing member 363 and opening the valve 361. The protruding member is circumvented by a sealing ring (not shown) so as to prevent the escape of CO2 gas from the bottle 360 during use.

The cylindrical housing 352 of the connecting arrangement 351 has an opening 356 at the lower end which has a form complementary with the flange 367 of the valve 361. In use the cylindrical housing 352 is placed over the flange 367 and the valve as is shown in Fig. 35b. Next, the bottle 360 is rotated over 90° as is shown in Fig. 35b. The lower end of the connecting means 354 is provided with two lips 357 (see also Fig. 36) which fit over the straight edges of the flange 367. These lips 357 are in Fig. 35c just above the straight edges of the flange 367. Next the connecting means is moved downwards by pushing a lever 358 down as is shown in Figs. 35d and 36. The lever 358 rotates about an axis 359 which is provided with a cam 370. The cam 370 engages the top surface 354a of the connecting means 354. The rotation of the cam 370 results in the connecting means 354 being pushed down to the connected position (see Fig. 35e). In this connected position the lips 357 are positioned over the straight edges 367a. This prevents that the bottle is rotated with respect to the connecting means 354 during use, which could lead to damaging of sealing means and/or the leakage of CO2 gas.

The receiving means 67 have a compression chamber 68 with a variable volume. The compression chamber 68 is delimited by a piston 69 with a screw spindle 69a that is driven by a linear electric motor 69b. The piston is adapted to engage the bottom 3 of the container 1.

In other possible embodiments (not shown) the drive means can comprise pneumatic means, hydraulic means or can be adapted to be hand driven.

The piston can have a form adapted to deform the container in a specific form. In Fig. 7 is schematically shown that the piston 69 has a flat front face 69c with a diameter that corresponds substantially with the inner diameter of the compression chamber 68.

In Fig. 21a is shown another piston 210 with a rear portion 210b with a constant diameter that substantially corresponds to the inner diameter of the compression chamber 68, and with a substantially cone shaped front portion 210a with a front face 210c which has substantially the same diameter as the bottom 3 of the container 1. The cone shaped portion 210 has a surface 210d with a convex curved form. This form of the piston 210 allows the container 1 to deform and wrinkle in the area between the surface 210d of the cone shaped portion 210a and the wall 68a of the compression chamber 68, as can be seen in Fig. 21b.

In Fig. 22a is shown a piston 220 with a cone shaped portion 220a with a linear decreasing surface 220d. The front face 220c has a smaller diameter than the diameter of the bottom 3 of the container 1. The form of the piston 220 allows the container 1 to deform and fold in the area between the surface 220d of the cone shaped portion 220a and the wall 68a of the compression chamber 68, as can be seen in Fig. 22b.

The pistons 210 and 220 can advantageously be used to compress the container 1 such that almost all substance in the filling cavity is dispensed. This means that there are only small losses which is advantageous from an economic view point.

In Fig. 24 a piston 240 is shown with a scraping edge 241. The scraping edge 241 prevents that during compression of the container no container material gets stuck between the inner surface 68a of the compression chamber 68 and the piston 240, which could cause jamming of the piston.

The receiving means 67 have a covering lid 80 which hinged and can be opened (see Fig. 8) and closed (see Fig. 6). Further, the receiving means 67 have a front plate 81. The front plate 81 is provided with a recess 82 with a depth substantially corresponding to the thickness of the circumferential rim 5 with the extending tab 8

and the gripping tab 11 of the container 1. The bottom of the recess 82 forms a stop face engaging the back side of the circumferential rim 5. Further, there is provided in the recess 82 a deeper recess 83 in which the dispensing channel 9 of the container 1 can be received. This deeper recess 83 has the advantage that the container 1 can only be placed in one manner in the receiving means, thereby securing a proper functioning and use of the apparatus.

The covering lid 80 is provided with a recess 84 which, when a container 1 is received in the receiving means, is placed over the zone 10b of the circumferential rim 10 near the dispensing channel 9.

In Fig. 9 is shown how a container 1 is placed in the receiving means 67. The perimeter of the recess 82 preferably fits around the perimeter of the circumferential rim 5 of the container 1 with the tabs 8 and 11 as is best seen in Fig. 10. In this way the container 1 can be placed only in one manner in the receiving means 67 and it is the dispensing channel 9 of the container 1 is always directed downwards such that the substance is always correctly dispensed in the cup 64 or another container positioned in the dispensing apparatus 61.

Then the covering lid 80 is closed such that the recess 84, is positioned over the zone 10b of the circumferential sealing seam 10 near the dispensing channel 9. The inside of the covering lid 80 forms a support surface which supports the cover sheet 7. At the position of the recess 84 the circumferential sealing seam 10 is of course not supported. Upon compression of the container body, whereby the substance is pressurized, the cover sheet 7 bulges out into the recess 84 such that the sealing seam 10 is broken at the zone 10b where the bulge is formed resulting in the container 1 being open as is described hereabove.

By further compression of the container body all the substance is dispensed into the cup 64 or another container. Then cold, warm or carbonated water can be added through the pipes 66a-66c. This can be done automatically as will be described further below. Then the covering lid 80 can be opened (Fig. 11) and the container 1 can be removed from the receiving means 67. Preferably there is provided a waste container 110 arranged under the receiving means 67, which can be opened by sliding it forward. The empty container 1 can fall into the waste container 110 after which the latter can be closed again.

In Fig. 11, but also in figs. 3, 4a-4c the container 1 is shown after compression. The bulge is indicated with reference numeral 7a. In figs. 4b and 4c is for clarity again indicated by arrows how the substance flows through the bulge 7a from the filling cavity into the dispensing channel 9.

Preferably the dispensing apparatus 61 comprises identification recognition means for automatically identifying the container 1 and the substance therein. To this end also the container 1 preferably comprises identification means. Preferably the identification means are applied to the cover sheet 7 of the container 1. The identification means could be visual identification means, e.g. a bar code or the like. Also electronic identification means are possible, more specifically comprising a resonance circuit or a transponder. The identification means applied to the container correspond to a specific substance contained in the container.

The identification recognition means could be a sensor 79 that is provided at the front plate 81 of the receiving means 67 as is shown in Fig. 7. Preferably a sensor 85, e.g. an optical sensor, a mechanical or an electronic sensor is provided on the covering lid 80 (see Fig. 8), such that when the covering lid 80 is closed the recognition means can detect if there is a container 1 present in the receiving means 67 and can recognize which container 1 with what specific substance is in the receiving means 67. The sensor 79 or 85 transfers the information from the identification means to the control system 75 (see Fig. 7) which for instance is provided with an electronic memory in which the recipes for several drinks can be stored. Another possibility is that the identification means on the container 1 contain the information for the recipe which is then transferred to the control system 75.

For example, if a container 1 with concentrated coffee substance is placed in the receiving means 67 the dispensing apparatus 61 will automatically know that there has to be added a certain predetermined amount of hot water to the cup 64.

Preferably the dispensing apparatus 61 has a control panel or control buttons 78 with which a consumer can dispense water of his choice (hot, cooled, carbonated, ambient) in the cup without placing a container 1 in the receiving means 67.

Preferably the dispensing apparatus has a display 76 connected to the control system 75. On the display 76 the drink can be displayed of which the corresponding container with the substance is placed in the receiving means 67. Also a start button can be provided by operation of which the dispensing of the substance and the water starts. In this way the consumer is allowed a last check on the display 75 if he has placed the right container 1 in the receiving means 67.

The identification means could also correspond to the amount of substance in the container. There can be containers with different amounts of the same substance. Thus it is possible to have a container for the preparation of one glass of a drink, but it is also possible to have a container for the preparation of a whole bottle of that drink. The dispensing apparatus can determine by means of the identification means and the identification recognition means what amount of water has to be added to the substance to get the right concentration for the drink.

With regard to this aspect the apparatus is preferably able not only to recognize the container that is placed in the receiving means, but also to recognize the serving container. For example a sensor is arranged which can detect whether there is placed a bottle 230 in the apparatus 61. This sensor can be connected to the control system 75. The control system 75 can determine whether a bottle 230 is placed in the dispensing apparatus 61 if a container 1 for the preparation of a bottle is placed in the receiving means 67. If not, the control system will block the dispensing of water. In this way the spilling of fluid can be prevented in case a too small serving container is placed in the dispensing apparatus. In a preferred embodiment the top part 231 of the bottle 230 (see Fig. 23) can be provided with identification means, e.g. a certain form which fits exactly in a corresponding receiving member in the dispensing apparatus. In this manner the dispensing apparatus only works with this bottle and can be guaranteed that no spilling of the drinks can take place.

With the present apparatus 61 in combination with the container 1 the substance is directly dispensed from the container 1 in a serving container like the cup 64, a glass, a jug, a decanter, a bottle or the like. The substance is treated by mixing it in the

serving container with a certain amount of water. The advantage of this is that the dispensing apparatus is not contaminated with the substance. Therefore, there cannot occur a cross-contamination between substances if different drinks are prepared subsequently. The water can be added to the substance afterward, but it is also possible to dispense water into the serving container before the substance is dispensed into it. Also a simultaneous dispensing of substance and water is possible.

In a further embodiment of the dispensing apparatus a heating element is provided as is shown in Fig. 20. In the figure is shown a container 1 with part of the body arranged in the compression chamber 68 of the receiving means 67. The covering lid 80 is closed and supports the covering sheet 7 of the container 1. At the recess 84 in the covering lid 80 is arranged a heating element 200, which is biased against the covering sheet 7 on the extending tab 8 of the container 1 by a spring element 201 between the dispensing channel 9 and the filling cavity. Emerging from the front plate 81 of the receiving means 67 under the compression chamber 68 is arranged another heating element 202 that is biased against the backside of the extending tab 8 by a spring element 203. The heating elements 200 and 202 are used to heat the covering sheet 7 and the extending tab 8 at the zone 10b of the sealing seam 10 near the dispensing channel 9 of the container 1 before the container is compressed. In this way the sealing seam 10 is weakened at the zone 10b and will break at that zone 10b when the container body is compressed. It is also possible that one of the heating elements 200 and 202 is omitted.

In Figs. 25-31 is shown a receiving means 67 of a preferred embodiment of the dispensing apparatus. For clarity the covering lid 80 is not shown in these figures. For the same reason also the covering sheet of the container 1 is omitted in these figures.

Figs. 25a-31b show receiving means 567 which comprise a housing 590 with a substantially cylindrical bore 591. In the bore 591 a compression cylinder 580 is slidingly arranged. In the compression cylinder 580 a piston 569 is slidingly moveable. Thus a compression chamber 568 is formed and delimited by the inner surface of the compression cylinder and the piston 569. The piston 569 is coupled to a a screw spindle 569a that is driven by an electric motor 569b. At a rear side the housing 590 has a back plate 583. The screw

spindle 569a and part of the motor 569b extend through an opening 584 in the back plate 583.

The cylinder 580 is provided with a pair of guiding bores 540, 541 which extend parallel to the axis through the cylinder 580 over its entire length. A pair of guiding rods 530 and 531 is arranged slideable within the guiding bores 540 and 541. The guiding rods 530 and 531 have an end portion 530a and 531a which is attached to the back plate 583 of the housing 590.

Between a rear end of the compression cylinder 580 and the back plate 583 of the housing 590 a pair of compression springs 585 and 586 is arranged around the guiding rods 530 and 531. The compression springs 585, 586 force the compression cylinder 580 to a front position within the housing 590 as is shown in Figs. 25 and 26. In the front position, the front face 581 of the compression cylinder 580 is in the same plane as the front face 591 of the housing 590. The front face 581 of the compression cylinder 580 is provided with a recess 582 similar to the embodiment of the receiving means 67 shown in Figs. 8-10. The form of the recess 582 is best seen in Figs. 29a and 30a where the container 1 is removed.

Advantageously the circumferential rim 5 of the container 1 is provided with a pair of positioning projections 601 (see Fig. 32) which fit into the guiding bores 540, 541 as can be seen in Fig. 25a. In this way the container 1 can be placed in the receiving means only in one way.

The bore 591 in the housing 590 has in a front part an opening 592 towards the bottom side. A receptacle 510 is arranged directly under the opening 592 for receiving empty containers 1 as will be described later.

The working of the embodiment shown in Figs. 25-31 will be explained in the following.

In Figs. 25a and 25b the receiving means are in a first state in which a full container 1 is placed in the receiving means 567. The compression cylinder 580 is in a front position within the housing 590. The circumferential rim 5 of the container is arranged within the recess 582 and the projections 601 are arranged within the guiding bores. The piston 569 is in a rear position within the compression cylinder 580.

Next, the container 1 is compressed by moving the piston towards a front psoition in the cylinder 580 as is shown in Figs. 26a and 26b. The container 1 is of course supported by a covering lid which is not shown in these figures.

After compression of the container 1 the piston 569 is retracted towards the rear position within the compression cylinder 580. Then the rear side of the piston abuts a rear abutment face arranged on the cylinder. By retracting the piston 569 further, the cylinder 580 moves along with the piston 569 as is shown in Figs. 27a and 27b.

By moving the piston 569 even further rearwardly the cylinder 580 is moved rearwardly towards a position in which the guiding rods 530, 531 within the guiding bores 540, 541 will abut the positioning projections 601 on the circumferential rim 5 of the container 1. By retracting the piston 569 and the cylinder 580 even further the stationary guiding rods 530, 531 will eject the positioning projections 601 from the guiding bores 540, 541. Thus the container 1 is ejected from the receiving means 567 as is shown in Figs. 28a and 28b. The guiding rods 530, 531 thus have the function of ejection means.

The container will fall down through the opening 592 into the receptacle 510 as is shown in Figs. 29a and 29b. It must be noted that the ejection of the container 1 takes place while the covering lid (not shown) of the receiving means 567 is still closed.

Next the piston 569 is moved forward again. The springs 585 and 586 force the cylinder 580 forwardly (see Figs. 30a and 30b) towards its front position (see Figs. 31a and 31b). In the state shown in Figs. 31 a and 31b the receiving means 567 are ready to receive a new filled container 1.

The positioning projections 601 on the circumferential rim 5 (see Fig. 32) can be formed in the rim during the thermo forming process used to manufacture the container 1. This has the advantage that the position of the projections 601 with respect to the cavity and the rest of the container 1 can be formed accurately, such that its proper functioning as positioning means can be assured.

The projection 601 can be used to establish whether the container is placed in the receiving means 567. To this end a sensor can be arranged within one or both of the guiding bores 540, 541. As

can be seen from the embodiment of the container 1 shown in Fig. 33 the circumferential rim 5 can have more than two, in this specific example four, projections 602. The projections 601 can be used for identifying the container 1, and more specifically the content of the container 1. By providing the receiving means with four guiding bores in which the positioning projections 602 fit preferably tightly and by providing the guiding bores with sensors the projections could be used as identification means. To this end an identification code could be composed by varying the number of projections 602 and the length of the projections, which can be determined by the sensors. The sensors used can be optical sensors, but also any other suitable type of sensor.

In Fig. 32 can be seen that the container body has a substiantially cilindrical side wall 4 with a flat wall portion 41. This flat wall portion 41 can be used to provide a label with a bar code on, such that the bar code can be read properly from a flat surface by a bar code reader (not shown). The bar code is used as identification means as described hereabove. The bar code can be oriented such that it is read in the axial direction of the container body. The label with the bar code can be applied to the flat portion 41 by a per se known in-mold labeling method.

In the above description the container 1 has a smooth side wall. It is however also possible to have a corrugated side wall as is shown in Fig. 12 or stepped as is shown in Fig. 13. This allows an easier compression of the respective containers 121 and 131.

Another embodiment of a container is shown in Fig. 14a. The container corresponds substantially with the container 1 shown in figs. 1-2. Therefore the corresponding elements are designated with the same reference numerals and will not be further described here.

The difference with the container from Fig. 1 is that the extending tab 8 has a dispensing channel 9 formed in it that does not end at the edge of the extending tab 8. The dispensing channel 9 thus has a closed end 9b. The extending tab 8 is provided with a transverse line of rupture 128. The line of rupture 128 crosses the dispensing channel 9b substantially perpendicular. The line of rupture 128 can be formed during production of the container 1 by applying a cross cut 130 at the underside of the extending tab 8. The cross cut 130 is shown in more detail in Fig. 14b. The cut 130

extends partly through the thickness of the tab 8. The covering sheet 7 can be provided with a prescore at the location corresponding to the line of rupture 128.

In use a consumer can separate the end part 8b of the extending tab 8 from the rest by pulling it upwards, as is illustrated in Fig. 14a by the arrows 129. The extending tab 8 will break at the rupture line 128 and the part 8b with the piece of covering sheet applied thereto will be separated which leaves the dispensing channel 9 with an opened end 9a, as is shown in Fig. 14c. The container 1 can then be placed into the dispensing apparatus 67 for further use. The advantage of this container 1 is that the dispensing channel 9 is sealed from the environment until the moment of actual use, whereby the risk of contamination with dirt or the like is eliminated. A hygienic container is thus provided which is well adapted for the use with food products.

In another embodiment of the container is shown in Fig. 15 in a top view. The circumferential rim 5 has a flat extending tab which is covered by the cover sheet. In the figure the cover sheet is not shown, to make the sealing seams visible. The cover sheet is sealed to the extending tab 8 by at two substantially parallel sealing seams 135 which extend outwardly from the circumferential sealing 10 seam to the edge of the extending tab 8. When in use the circumferential seal 10 breaks at the zone 10b the substance will flow from the filling cavity through the dispensing passage formed by the tab surface and the covering sheet, between the two sealing seams 135 as is indicated by the arrows. At the edge of the extending tab 8 there can be provided an extra seal 136, but this end could also be open, i.e. not sealed to the tab 8, as is shown in Fig. 15a. In an especially advantageous embodiment of the container shown in Fig. 32 the weakened zone 10b has a middle portion 10c pointing in the direction of the cavity of the container as is best shown in Fig. 15b. This has the effect that the seal will break first at the middle portion 10c and then will develop towards the sealing seams 135 where the breaking of the seal will stop.

Preferably the covering lid 80 of the dispensing apparatus has a recess 84a with an elongated form (see Fig. 15c) which is adapted to cooperate with the passage between the seals 135 of the container shown in Fig. 15, Fig. 15a or Fig. 15b. In use the covering sheet of

the container of Figs. 15-15b, which is compressed in an apparatus with a covering lid 80 as is shown in Fig. 15c will bulge out in the form of a channel 150 as is shown in Fig. 15d. Result of this is that a film jet 151 of substance is expelled from the container. Preferably a film jet 152 of water is expelled from a flat nozzle head 153 that is provided on the central dispensing pipe 50 of the dispensing apparatus. A good mixing of substance and water takes place due to the large contact surface between the water film jet 152 and the substance film jet 151. Another advantage is that a well defined jet of substance is provided without splashing and thus possible contamination of the dispensing apparatus. A further advantage of the thus formed passage 150 between the seals 135 is that if after compression of the container 1 the pressure is relieved, the residue of substance in said passage 150 will be retracted due to an underpressure in the cavity of the container 1, which underpressure also results in sucking the covering sheet of the container 1 onto the rim 8. These effects, which can be characterized by the term "inhaling" effect, result in that after compression of the container 1 no substance is spilled anymore from the container 1, such that no contamination of the dispensing apparatus takes place.

Fig. 16 shows still another embodiment of a container. In the figure only the container body is shown. The elements of the container 161 that correspond to the elements of container 1 of Fig. 1 are indicated with the same reference numerals to which 160 is added. These elements will not be described here. The difference with the embodiment from Fig. 1 is that this embodiment has two filling cavities. The two filling cavities can contain different substances which have to be mixed. This can be useful in preparing certain drinks or food products, e.g. yogurt with syrup, coffee with cream but also an application where epoxy has to be prepared is possible.

The filling cavities can have the same volume as is shown in fig 16 and Fig. 18, but it is also possible that the filling cavities have a different volume as is shown in Fig. 17 and Fig. 19.

In Fig. 17 a container 170 is shown that has filling cavities with the same cross section, but with a different height. When this container 170 is compressed by a dispensing apparatus 67, the piston will first engage the bottom 173a corresponding to the filling cavity with the largest height and later the bottom 173b of the filling

cavity with the smaller height. This is for example practical if yogurt has to be served with syrup or a sauce on top.

In Fig. 19 a container 191 is shown that has filling cavities with different cross sections.

Of course it is also possible to have a container with filling cavities with a different height and with a different cross section.

In all embodiments of figs. 16-19 the substances from the two filling cavities are dispensed through one dispensing channel 169, 189, 199.

The containers filled with substance hereabove described are preferably manufactured by a method, wherein the containers are formed from a sheet of plastic material. First a flat sheet of plastic material is placed in a vacuum forming apparatus with a forming die. By vacuum forming the filling cavities into the die, multiple container bodies are formed simultaneously in the sheet. Possibly also dispensing channels 9 of the containers 1 are depressed by the vacuum forming machine in an extension tab, which is subsequently to be formed in the punch machine. The sheet with the filling cavity is placed in a filling machine and filled with substance. Subsequently a sheet 7 of covering foil is sealed over the sheet with the container bodies. Finally, the sheet with the closed containers is placed in a punch machine, where the perimeter of the circumferential rim of the body is formed by punching out waste material between the containers 1.

In the above described manner is also possible to manufacture two different types of containers simultaneously from one sheet. This is advantageous when two containers are to be used together. A possible application is that one container is like the container 1 already described, whereas the other container contains an additional food product. As an example one can think of a container with substance for soup that is placed in the receiving means 67 of the dispensing apparatus 61, and a second container filled with croutons that have to be added to the soup by the consumer after the apparatus 61 has prepared the soup.

In the above description the use for dispensing food products is mentioned. The container can be filled with concentrate for coffee, tea, chocolate, soup, dairy products like milk or yogurt drinks, fruit and vegetable juices, soft drinks and sport drinks.

The use of dispensing a substance from a container in the manner, as is described hereabove is however not only delimited to applications with food products. It is also possible to use this principle in non-food applications, e.g. in medical applications for dispensing a dose of a medicament.

CLAIMS

1. In combination:
- a container filled with a single portion of a substance, comprising a deformable body defining a filling cavity which body has an opening and an integral planar circumferential rim surrounding said opening, which opening is closed by a cover sheet of foil material which is sealed to the circumferential rim by means of a circumferential sealing seam, wherein the container is provided with identification means corresponding to the substance contained in the container so as to allow automatic identification of the container,
- a dispensing apparatus comprising receiving means for receiving the container, which apparatus is adapted to open the container and comprises identification recognition means for automatically identifying the container and the substance therein.

2. Combination according to claim 1, wherein the identification means are applied to the cover sheet of the container.

3. Combination according to claim 1, wherein the identification means are applied to the deformable body.

4. Combination according to claim 2 or 3, wherein the identification means are visual identification means, for example a bar code.

5. Combination according to claim 2 or 3, wherein the identification means comprise electronic identification means.

6. Combination according to claim 5, wherein the electronic identification means comprise a resonance circuit.

7. Combination according to claim 5, wherein the electronic identification means comprise a transponder.

8. Combination according to any of the preceding claims, wherein the dispensing apparatus comprises compression means for compressing the container body and wherein the sealing seam of the container on a predetermined location has a weak spot such that the seal breaks at

that weak spot upon pressurizing the content of the container by compressing the container body.

9. Combination according to any of the preceding claims, wherein the dispensing apparatus comprises treatment means for treating the substance dispensed from the container.

10. Combination according to claim 9, wherein the treatment means comprise liquid dispensing means for a liquid to be mixed with the substance from the container.

11. Combination according to claim 10, wherein the liquid dispensing means for liquid comprise means for dispensing cooled water and/or hot water and/or water with ambient temperature.

12. Combination according to claim 9 or 10, wherein the dispensing means for liquid comprise means for dispensing carbonated water.

13. Combination according to claim 12, wherein the means for dispensing carbonated water comprise in combination a connecting arrangement for connecting a CO2-bottle to the dispensing apparatus and a CO2 bottle.

14. Combination according to claim 13, wherein the CO2 bottle is provided with a closing valve and the connecting arrangement is provided with connecting means for opening the closing valve.

15. Combination according to claim 13, wherein the closing valve has a valve housing with a circumferential flange and the connecting means has engagement means for engaging said flange such that in a connected state a rotation of the valve housing with respect to the the connecting means is prevented.

16. Combination according to any of the above claims, wherein the receiving means of the dispensing apparatus have a compression chamber with a variable volume for receiving the container body, a stop face engaging the back side of the circumferential rim and a

covering lid with a supporting face for engaging the cover sheet of the container.

17. Combination according to claim 16, wherein the receiving means are provided with ejection means for ejecting a container from the receiving means.

18. Combination according to claim 17, wherein the ejection means comprise one or more ejection rods, the ejection rods being movable with respect to the stop face towards a position wherein they project with respect to the stop face and engage the circumferential rim of the container.

19. Combination according to claim 18, wherein the ejection rods are stationary and the stop face is movable with respect to the ejection rods between a front position near the covering lid and a rear position distant from the covering lid.

20. Combination according to claim 16-19, wherein the covering lid is provided with a recess arranged such that when the covering lid is closed it is positioned over a part of the sealing seam, so as to allow the cover sheet to bulge out into the recess upon compression of the container body and the sealing seam to break.

21. Combination according to any of the above claims, wherein the compression chamber is provided with a piston coupled to drive means, which piston is adapted to engage the container body.

22. Combination according to claim 21, wherein the drive means comprise a screw spindle and an electric motor.

23. Combination according to claim 21, wherein the drive means comprise pneumatic means.

24. Combination according to claim 21, wherein the drive means comprise hydraulic means.

25. Combination according to claim 21, wherein the drive means are adapted to be hand driven.

26. Combination according to any of the preceding claims, wherein the covering layer of the container is made of a multilayer material.

27. Combination according to any of the preceding claims, wherein the dispensing apparatus has dispensing means for different sorts of water, e.g. hot water, cooled water and carbonated water, which are positioned such that the different sorts of water can be dispensed at one point in a serving container like e.g. a cup or a bottle.

28. Container for containing a substance, comprising a deformable body defining a filling cavity which body has an opening and an integral planar circumferential rim surrounding said opening, which opening is closed by a cover sheet of foil material which is sealed to the circumferential rim by means of a circumferential sealing seam, wherein the circumferential rim has an extending tab with a dispensing channel formed by a depression in the tab which is covered by the cover sheet, the dispensing channel being closed off from the filling cavity by the circumferential sealing seam.

29. Container according to claim 28, wherein the circumferential sealing seam at the location between the channel and the filling cavity is weakened, e.g. by a decreased seam width, such that upon pressurizing the content of the container by compressing the container body the seal breaks at that location and a passage is formed between the cover sheet and the rim so as to allow substance to pass through the passage from the cavity into the channel.

30. Container according to claim 28 or 29, wherein the channel has an end at the edge of the extending tab.

31. Container according to claim 30, wherein the end at the edge of the extending tab is open.

32. Container according to claim 30, wherein the end of the channel at the edge of the extending tab is sealed.

33. Container for containing a substance, comprising a deformable body defining a filling cavity which body has an opening and an integral planar circumferential rim surrounding said opening, which opening is closed by a cover sheet of foil material which is sealed to the circumferential rim by means of a circumferential sealing seam, wherein the circumferential rim has a flat extending tab which is covered by the cover sheet, which cover sheet is sealed to the extending tab by at least two substantially parallel sealing seams which extend outwardly from the circumferential sealing seam to the edge of the extending tab.

34. Container according to claim 33, wherein the circumferential sealing seam at the location between the two parallel sealing seams has a weakened portion, e.g. by a decreased seam width, such that upon pressurizing the content of the container by exerting a compression force on the wall the seal breaks at that location and a dispensing passage is formed between the two parallel sealing seams, the cover sheet and the surface of the extending tab.

35. Container according to claim 34, wherein the weakened portion of the circumferential sealing seam at the location between the two parallel sealing seams has a pointed portion of which the point is directed towards the filling cavity such that upon compression of the container the seal starts to break a the pointed portion.

36. Container according to any of the claims 28-35, wherein a gripping tab is provided at the circumferential rim.

37. Container according to claim 36, wherein the gripping tab is situated diametrically opposite the extending tab.

38. Container according to any of the claims 28-37, wherein the container wall is formed of a plastic material.

39. Container according to any of the claims 28-38, wherein the covering layer is made of a multilayer material.

40. Container according to any of the claims 28-39, wherein the container body is formed by vacuum forming and/or thermo forming.

41. Container according to any of the claims 28-40, wherein the deformable body comprises a bottom and a side wall extending upwardly from the bottom.

42. Container according to claim 28-41, wherein the container body is corrugated so as to facilitate compression of the container.

43. Container according to claim 28-42, wherein the circumferential rim is provided with one or more positioning protrusions formed by a depression in the rim.

44. Method for manufacturing containers according to one of the above claims, wherein
- a flat sheet is placed in a vacuum or thermo forming apparatus with a forming die and multiple container bodies are formed simultaneously in the sheet by vacuum forming the filling cavities into the die,
- the sheet with the filling cavity is placed in a filling machine and filled with substance,
- a sheet of covering foil is sealed over the sheet with the container bodies,
- the sheet with the closed containers is placed in a punch machine, where the perimeter of the circumferential rim of the body is formed by punching out waste material between the containers.

45. Method according to claim 44, wherein in the vacuum or thermo forming machine also dispensing channels of the containers are depressed in an extension tab which is subsequently to be formed in the punch machine.

46. Method according to claim 44 or 45, wherein wherein in the vacuum or thermo forming machine positioning protrusions are depressed in the circumferential rim which is subsequently to be formed in the punch machine.

47. Method according to any of the claims 44-47, wherein the sheet of covering foil is manufactured and provided with identification means.

48. Method according to any of the claims 44-47, wherein identification means are applied to the container bodies by in-mold labeling in the vacuum or thermo forming apparatus.

49. Method for opening a container containing a substance, comprising a deformable body (made of sheet material) defining a filling cavity which body has an opening and an integral planar circumferential rim surrounding said opening, which opening is closed by a cover sheet of foil material which is sealed to the circumferential rim by means of a circumferential sealing seam,
the method comprising the steps of:
- holding the container,
- engaging the cover sheet with a support surface provided with a recess and adapted to support the cover sheet except at the position of the recess, wherein the recess is positioned at least over a part of the circumferential sealing seam,
- compressing the container body whereby the substance is pressurized and the cover sheet bulges out into the recess such that the sealing seam is broken at the location where the bulge is formed resulting in the container being open.

50. Method for opening a container containing a substance, comprising a deformable body (made of sheet material) defining a filling cavity which body has an opening and an integral planar circumferential rim surrounding said opening, which opening is closed by a cover sheet of foil material which is sealed to the circumferential rim by means of a circumferential sealing seam,
the method comprising the steps of:
- holding the container,
- engaging the cover sheet with a support surface provided with a recess and adapted to support the cover sheet except at the position of the recess, wherein the recess is positioned over at least a part of the circumferential sealing seam,
- heating the sealing seam at a position facing the recess, whereby the sealing seam is locally weakened,

- compressing the container body whereby the substance is pressurized and the cover sheet bulges out into the recess such that the sealing seam is broken at the location where the bulge is formed resulting in the container being open.

51. Serving bottle for use with the combination according to any of the claims 1-24.

52. CO2 bottle for use in a combination according to claim 13.

ABSTRACT

The invention proposes to dispense a substance from a container filled with a single portion of a substance. The container comprises a deformable body, preferably made of sheet material, defining a filling cavity which body has an opening and an integral planar circumferential rim surrounding said opening, which opening is closed by a cover sheet of foil material which is sealed to the circumferential rim by means of a circumferential sealing seam. The container with the substance is opened by making use of the deformability of the cover sheet. A support surface supports the cover sheet except at the position of a recess. The recess is positioned at least over a part of the circumferential sealing seam. Upon compression of the container body the substance is pressurized and the cover sheet bulges out into the recess such that the sealing seam is broken at the location where the bulge is formed resulting in the container being open.

fig.1

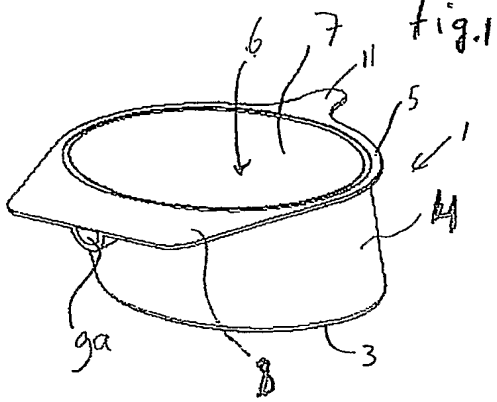
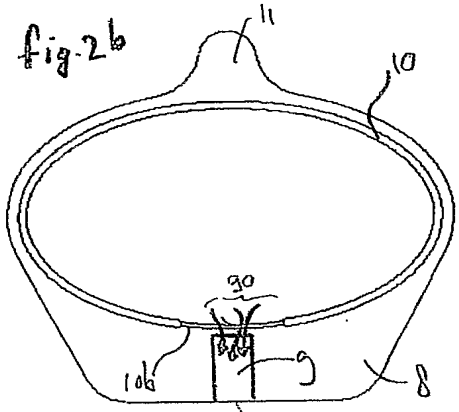


fig.2b



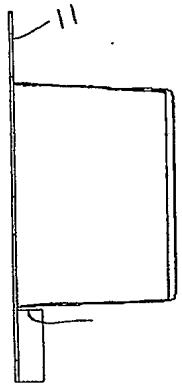


fig.2c

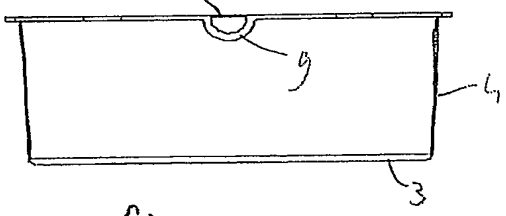


fig.2a

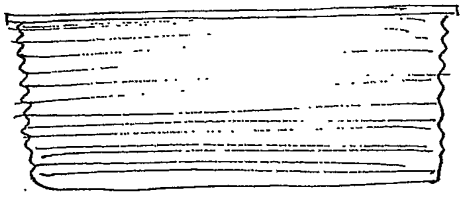


fig.12

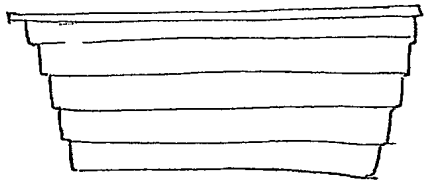


fig.13

fig. 3

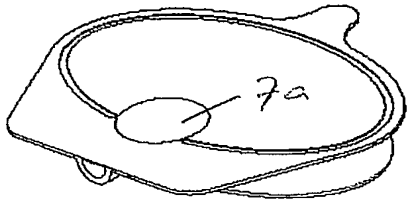
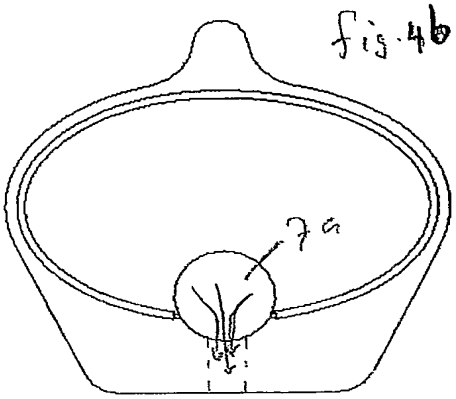


fig. 4b



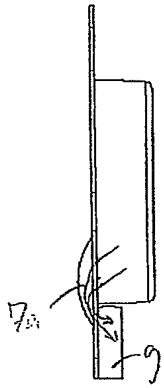


fig. 4c

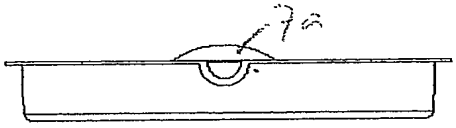


fig. 4a

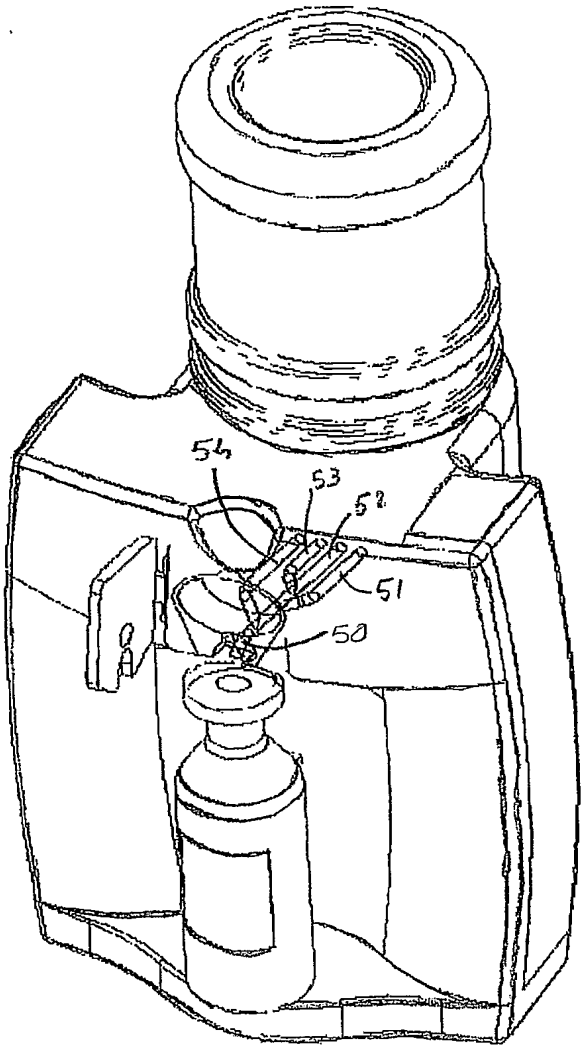
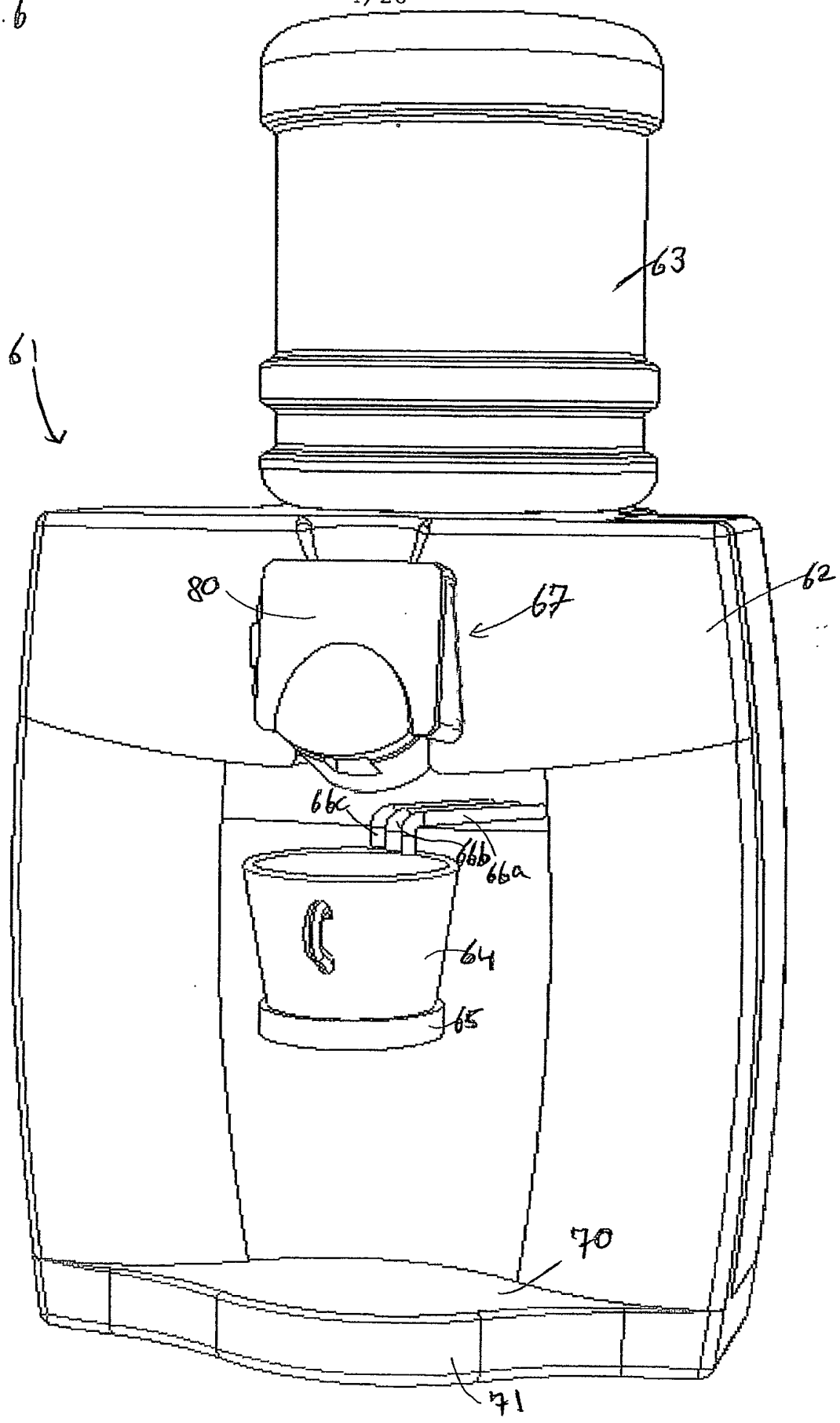


fig. 5

fig. 6



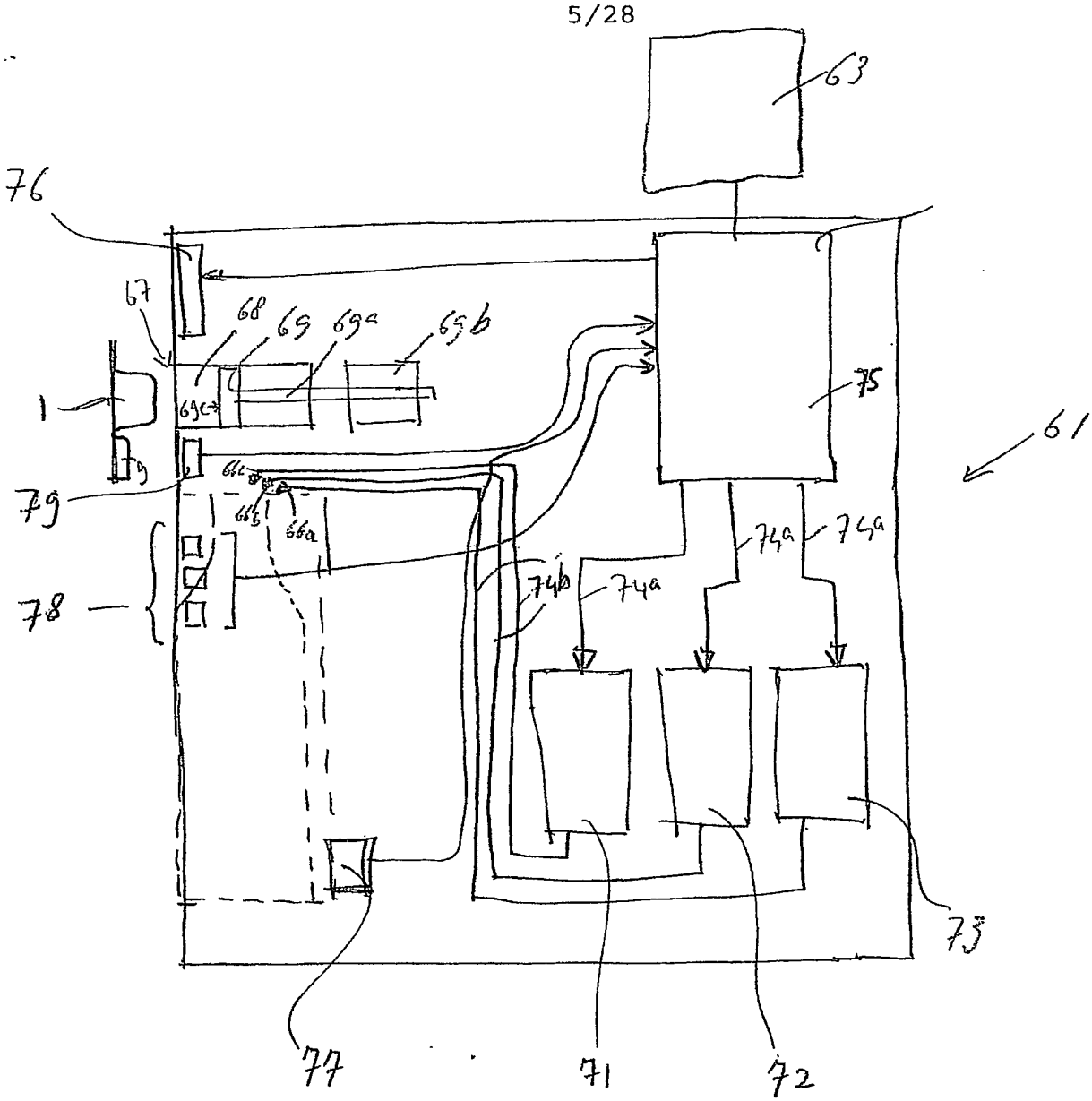
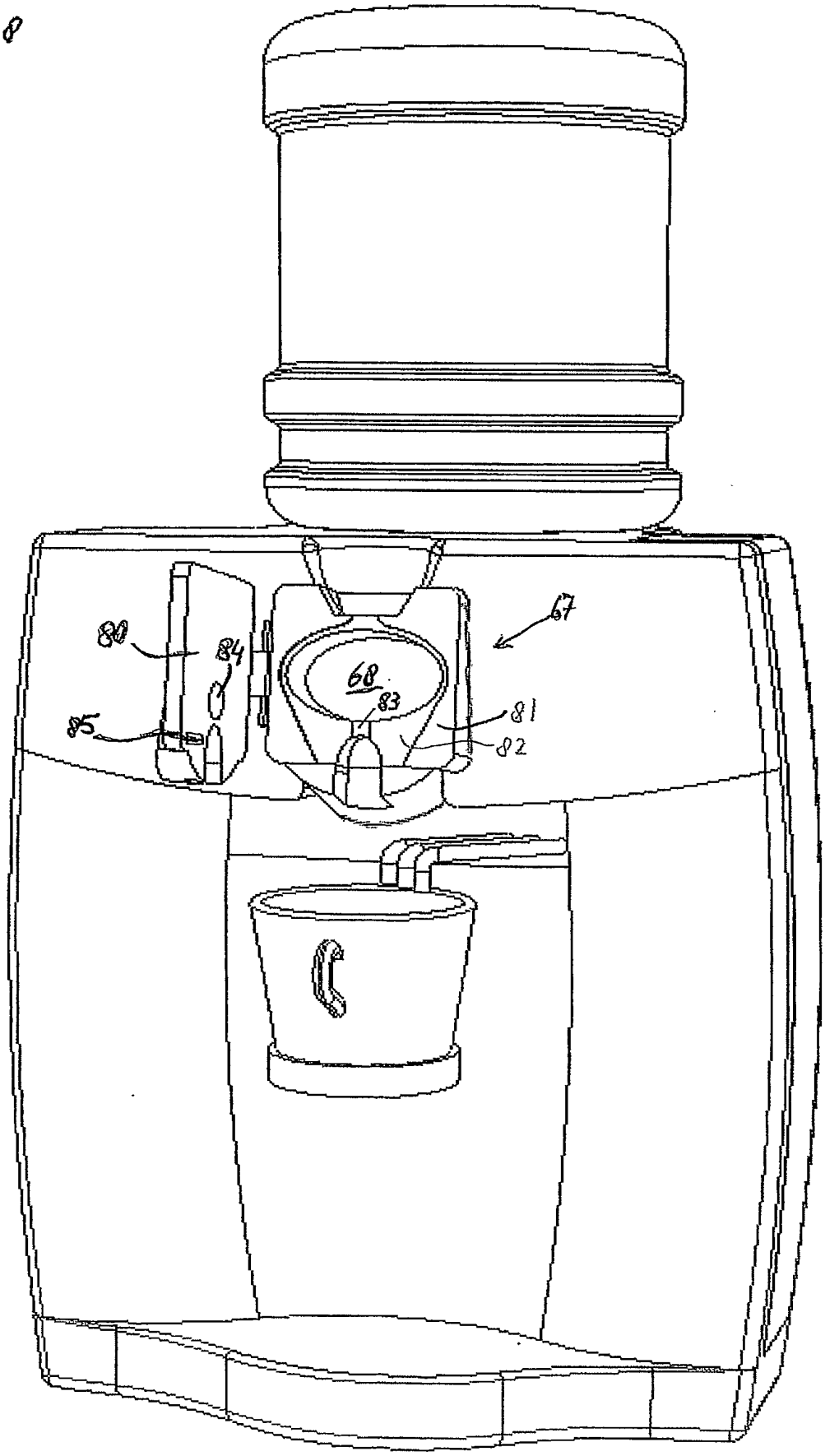

63
76
67
68
69
69a
69b
1
69c
75
61
79
66c
66b
66a
74a
74a
78
74b
74a
73
77
71
72

fig.7

fig.8



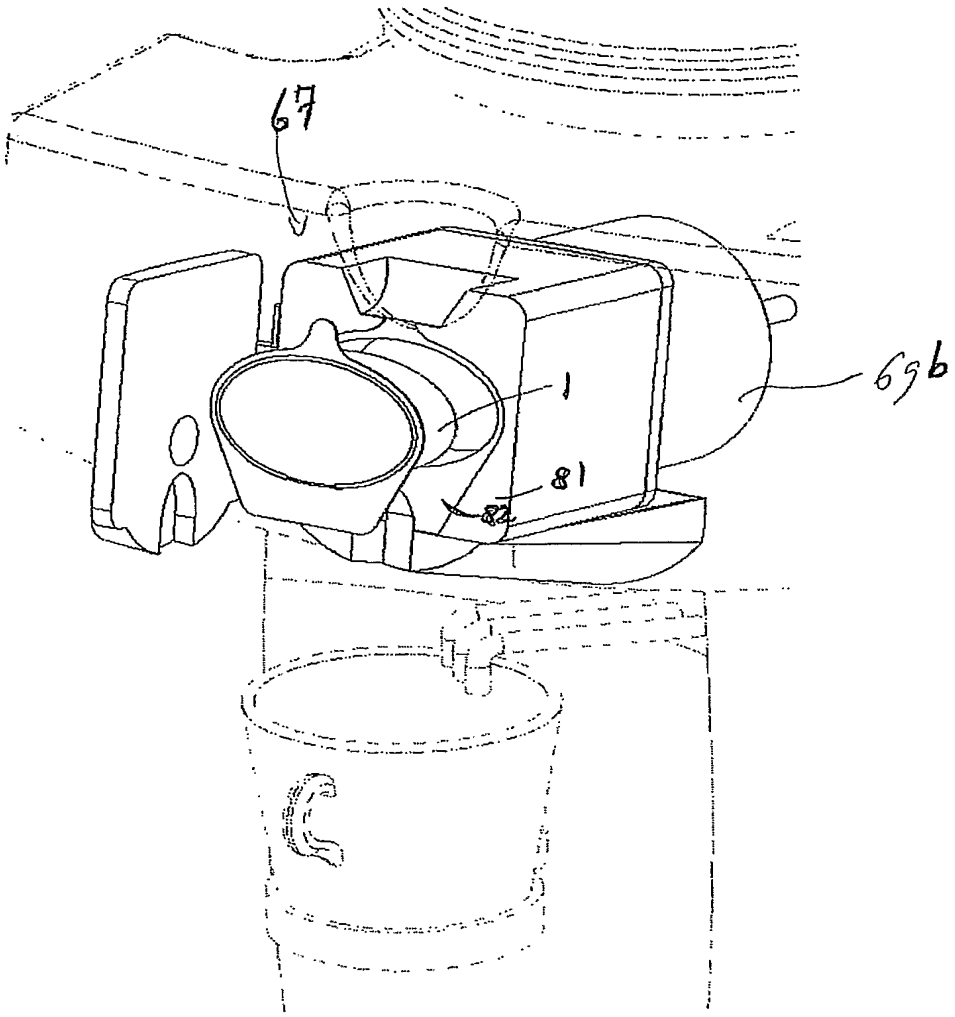


fig.9

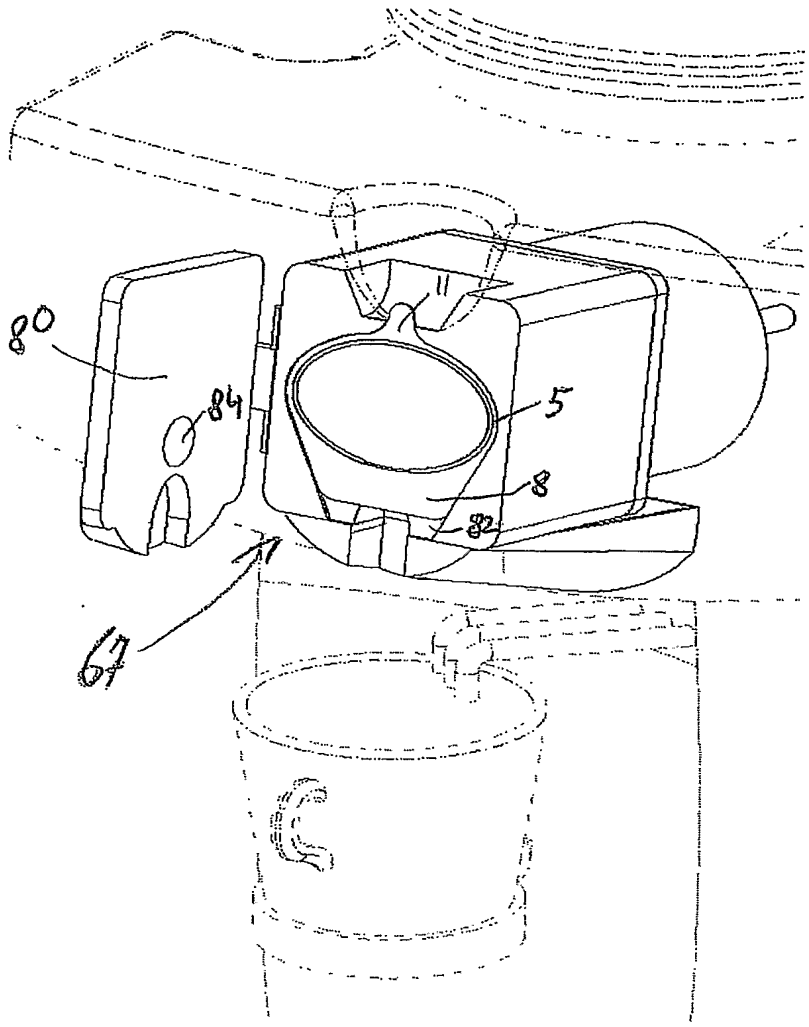


fig. 10

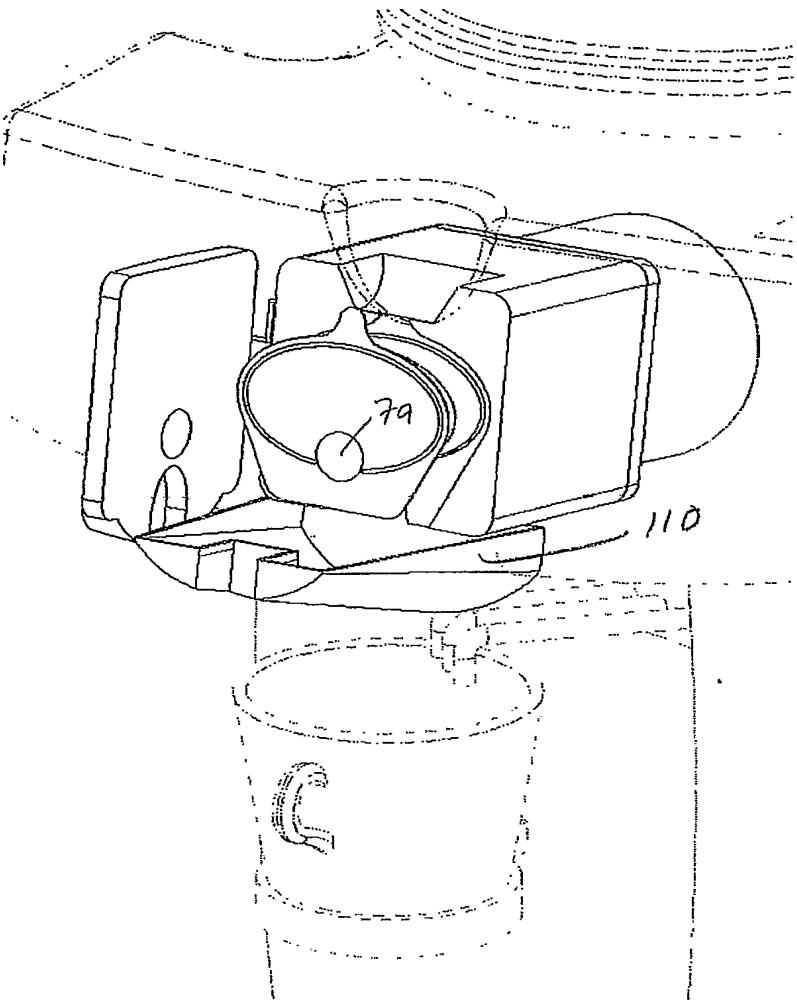


fig. 11

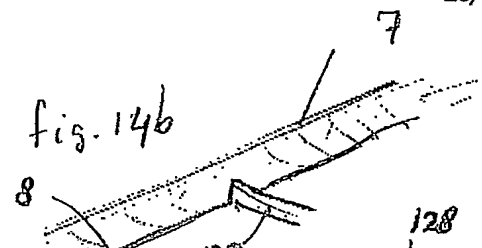


fig. 14b

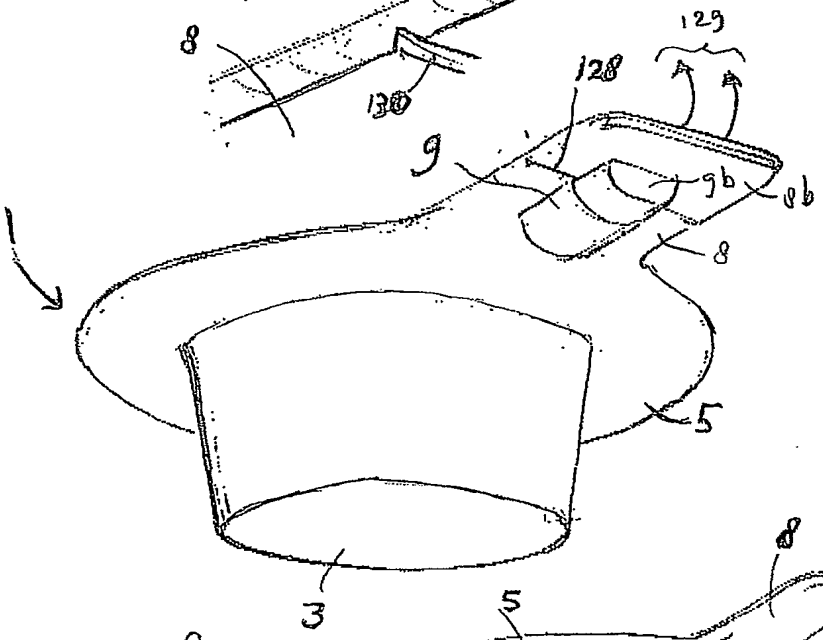


fig. 14a

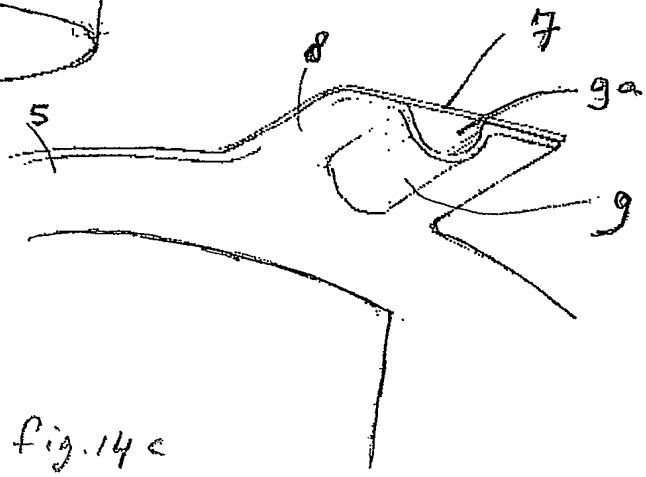


fig. 14c

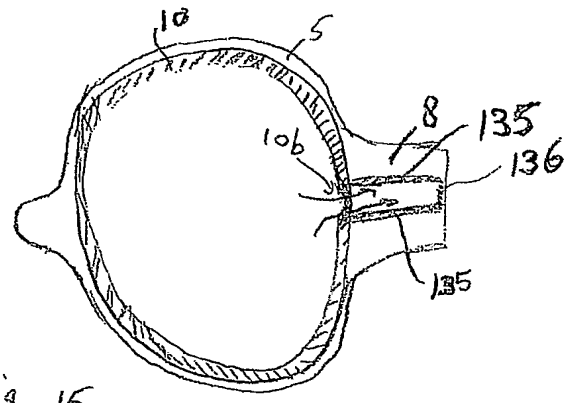


fig. 15

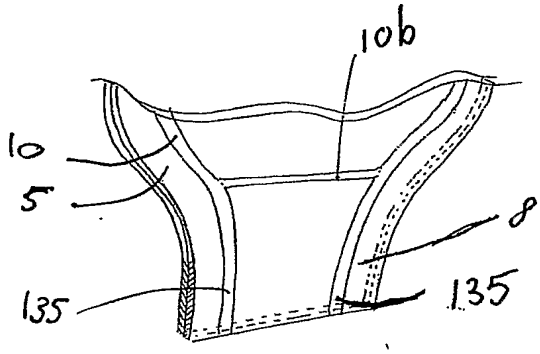


fig. 15a

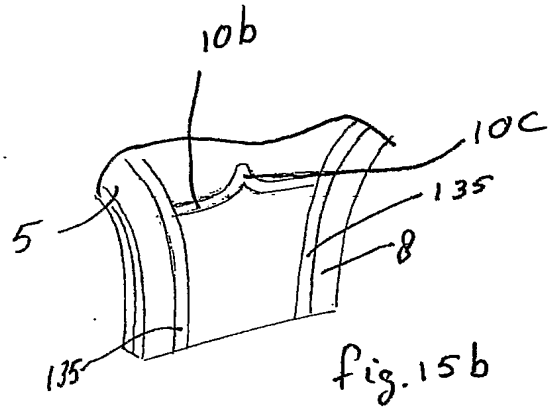


fig. 15b

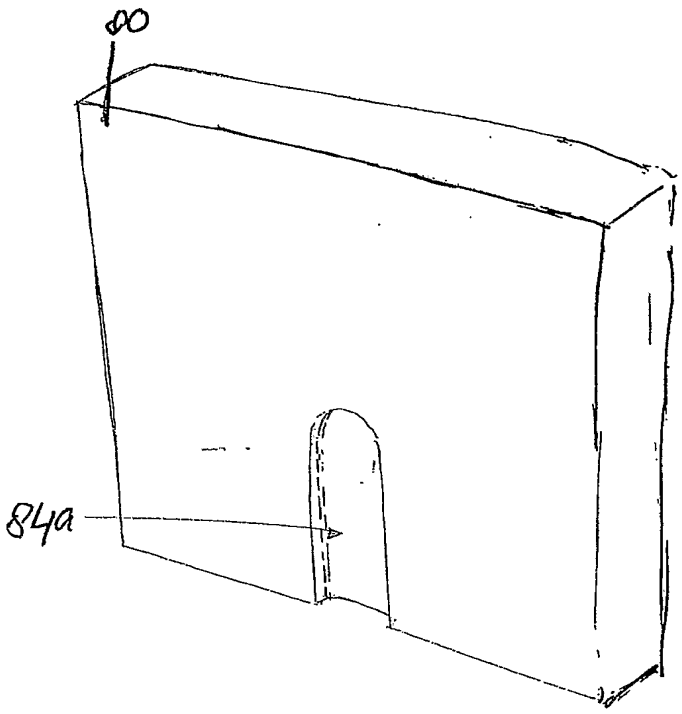


fig. 15c

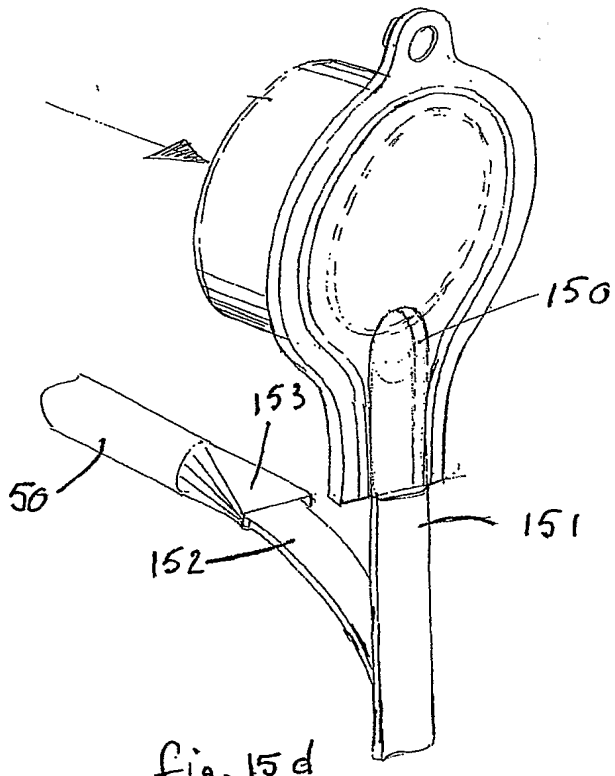


fig. 15d

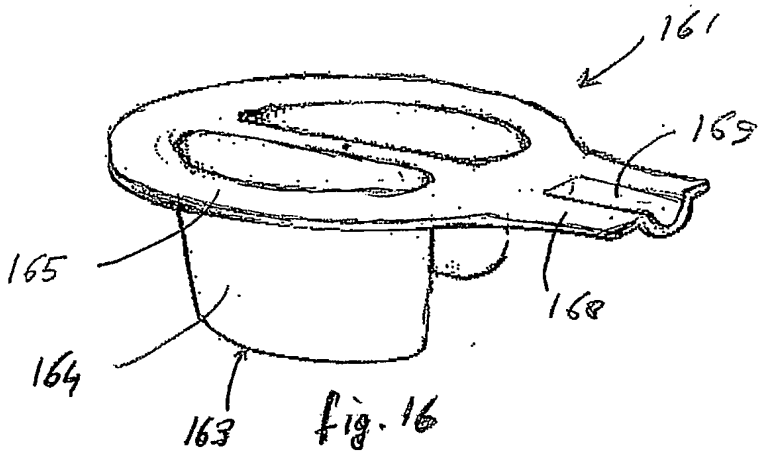


fig. 16

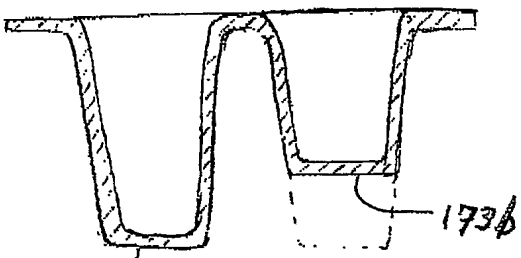


fig. 17

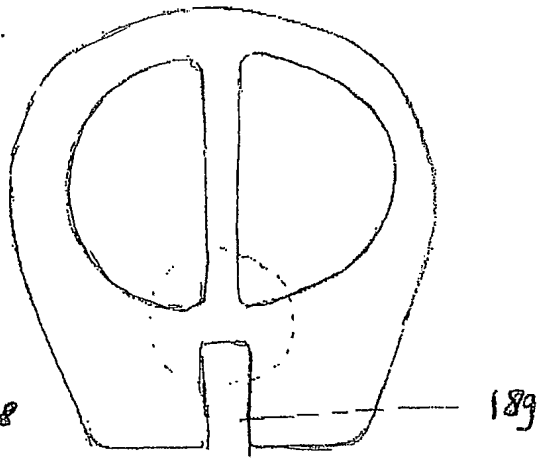


fig. 18

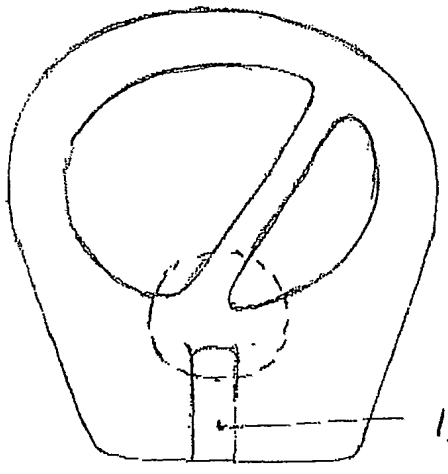


fig. 19

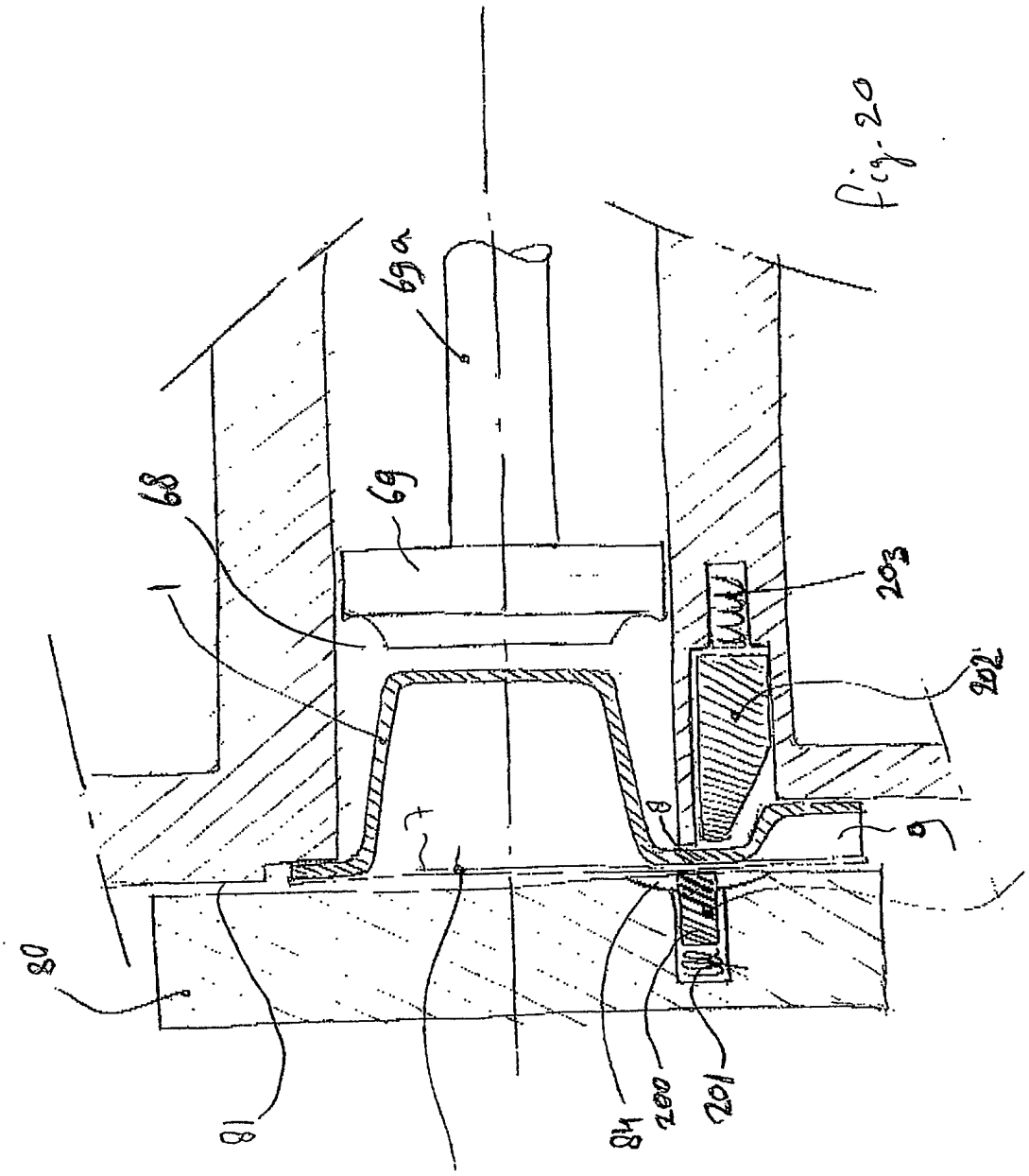


Fig-20

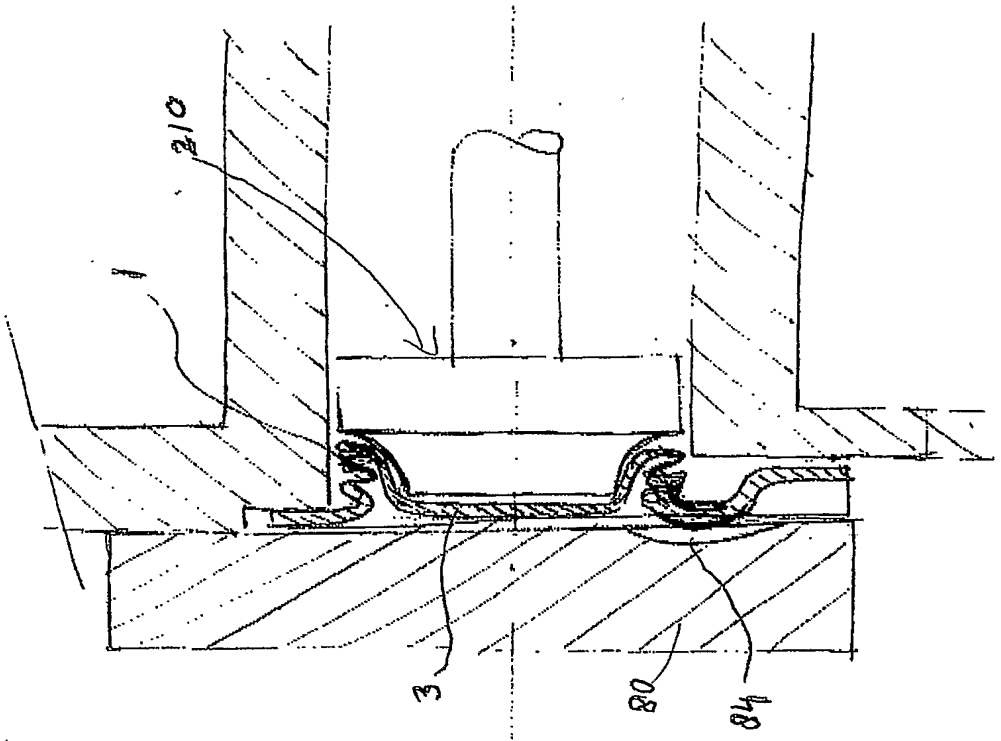


fig. 21b

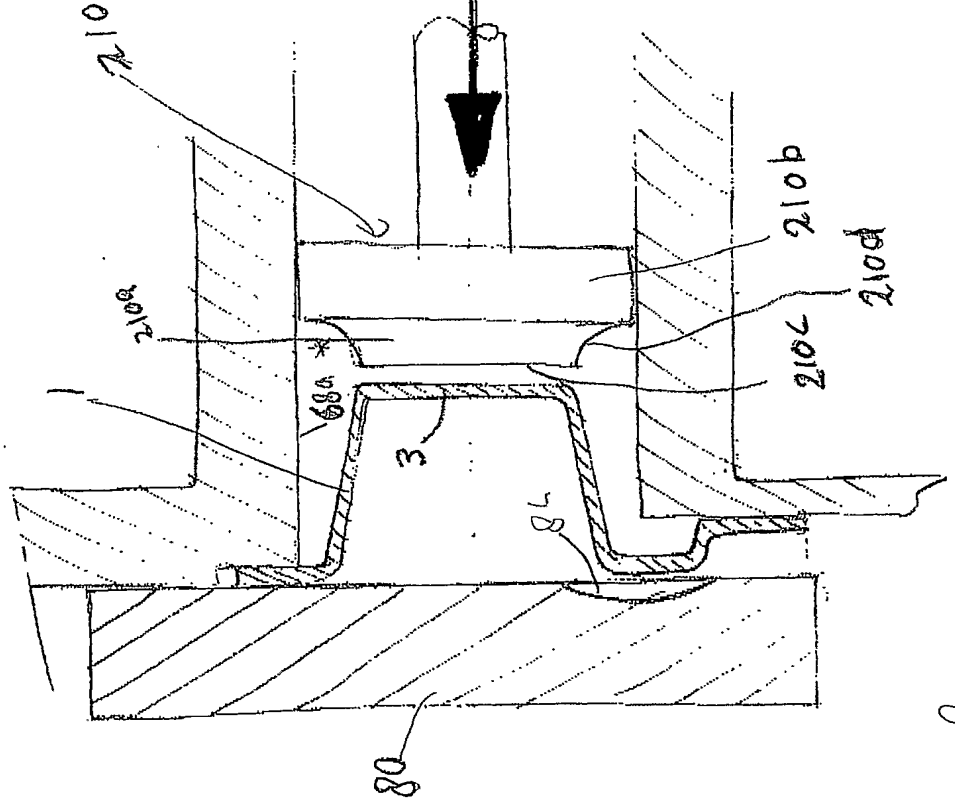


fig. 21a

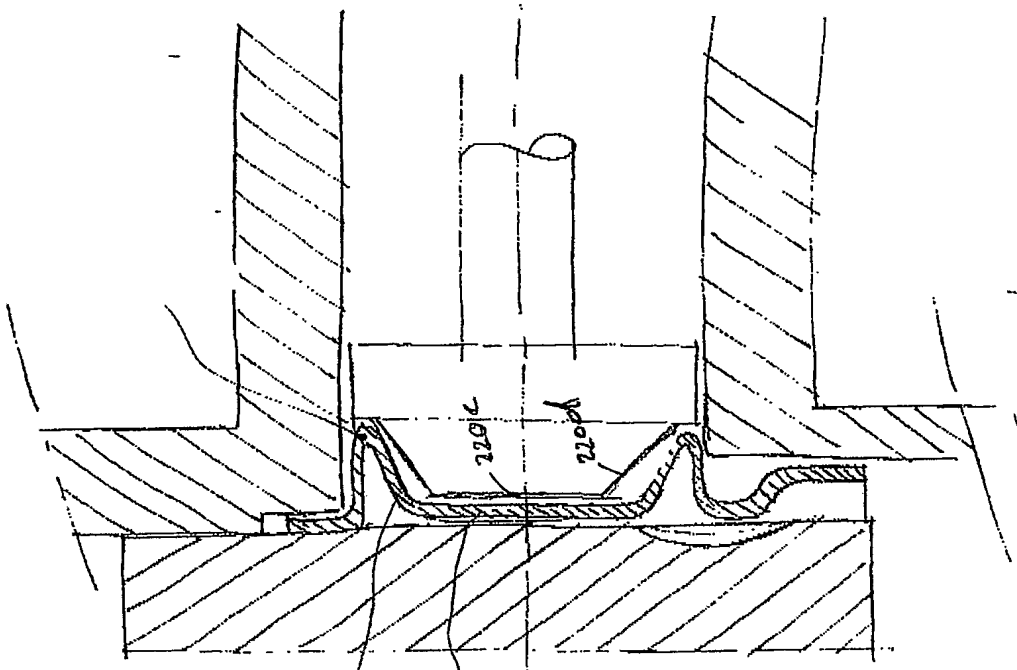


Fig. 22b

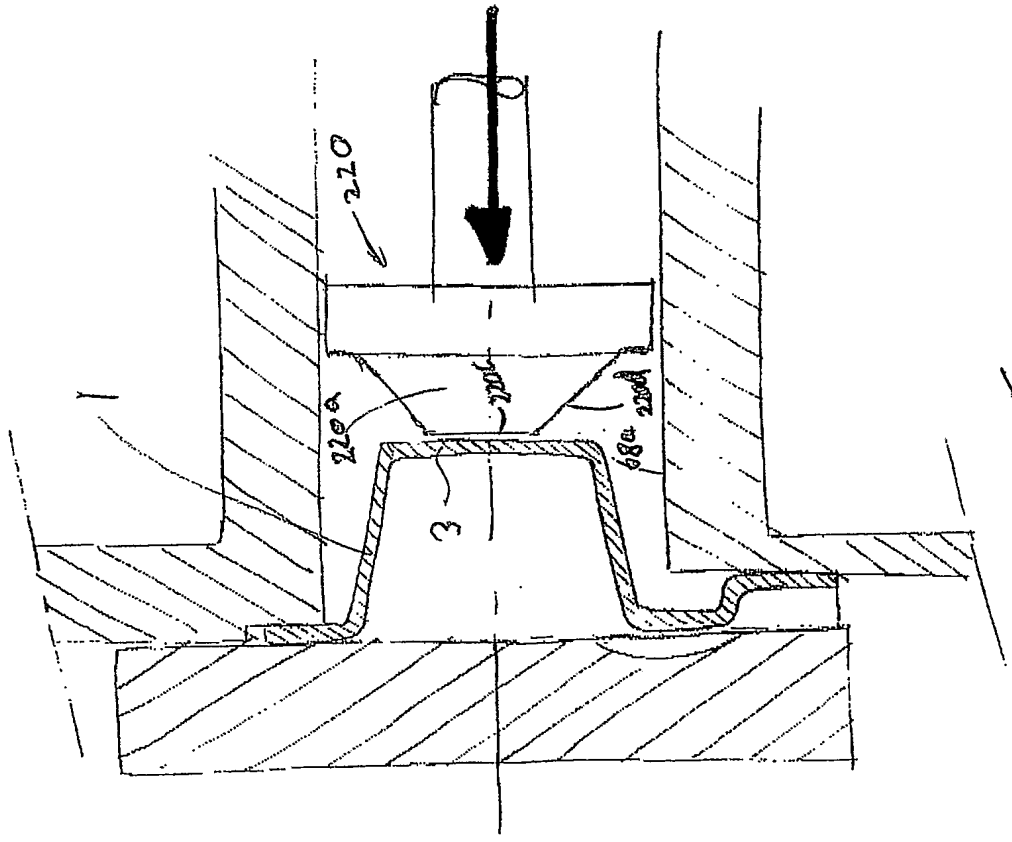


Fig. 22a

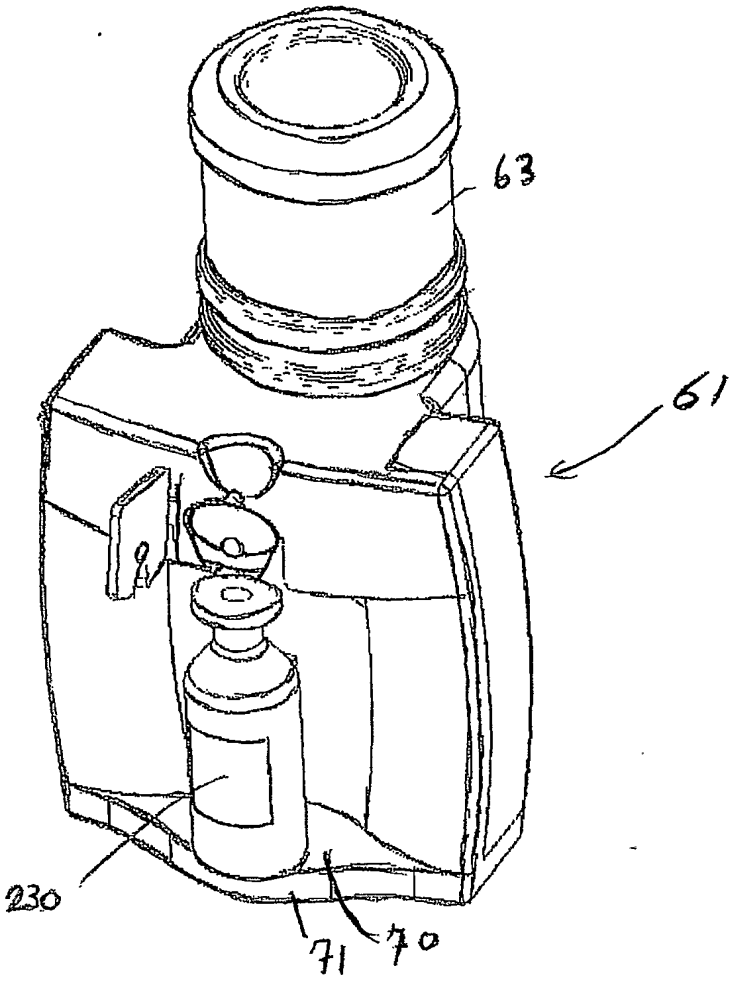


fig. 23a

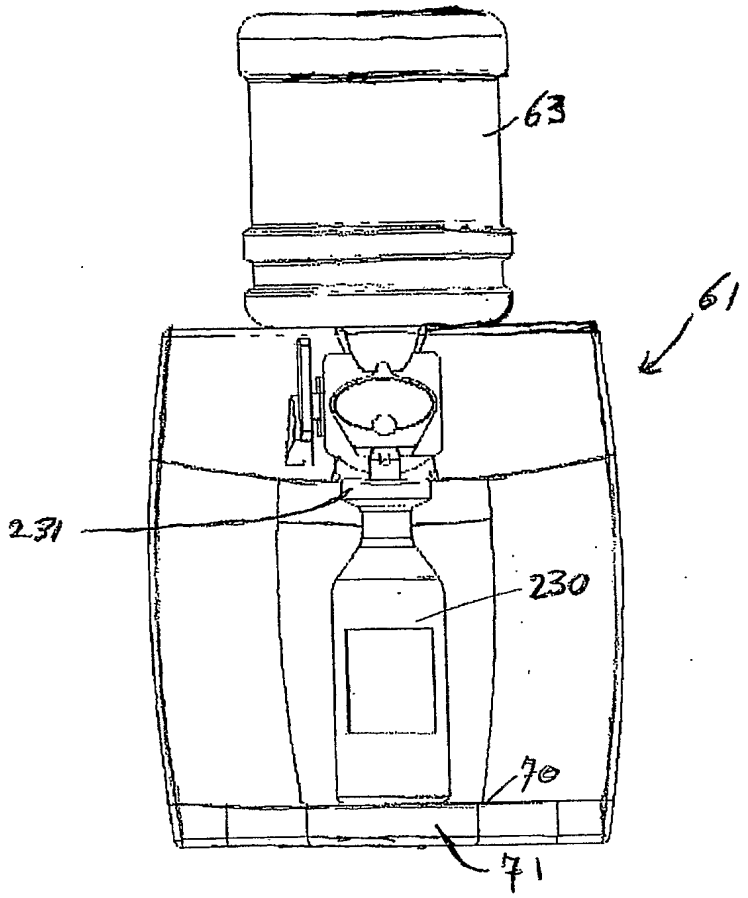


fig. 23b

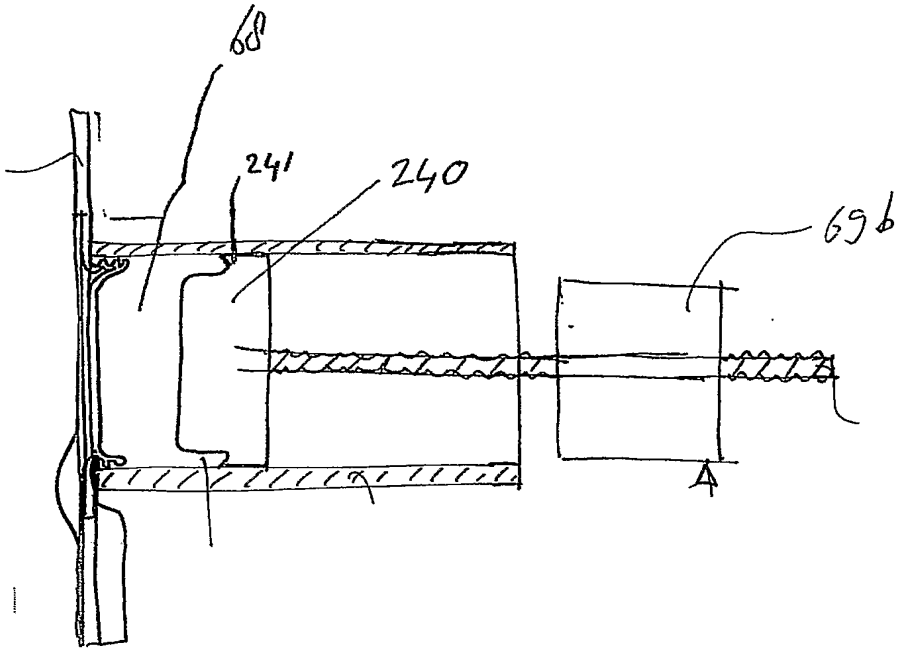


fig. 24

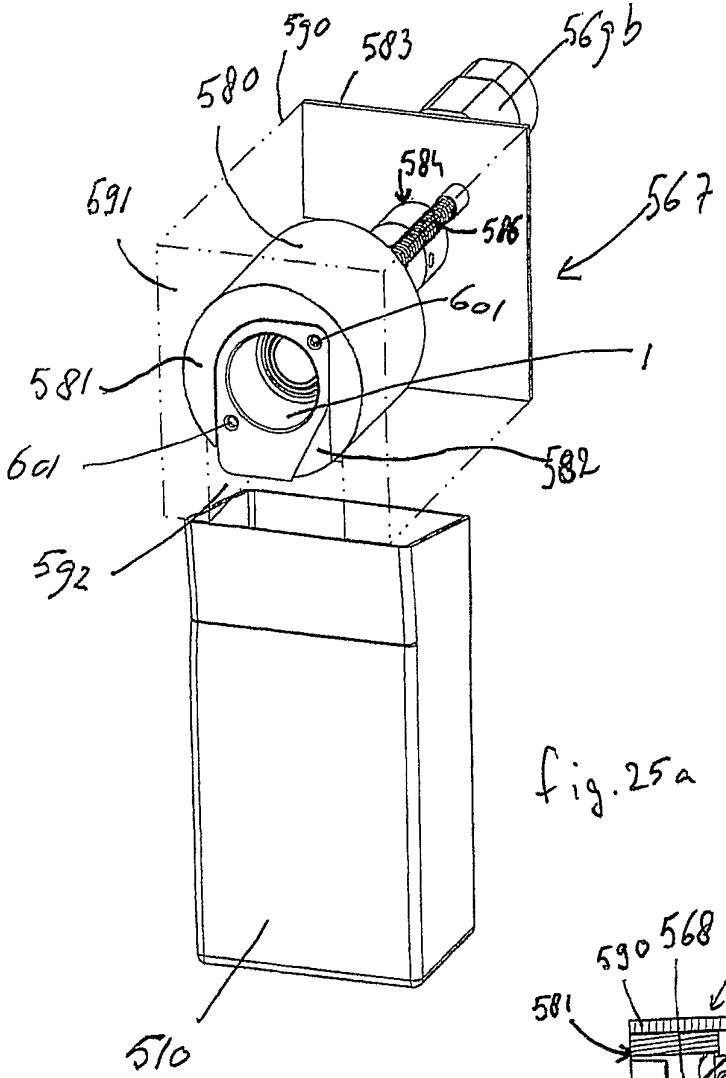


fig. 25a

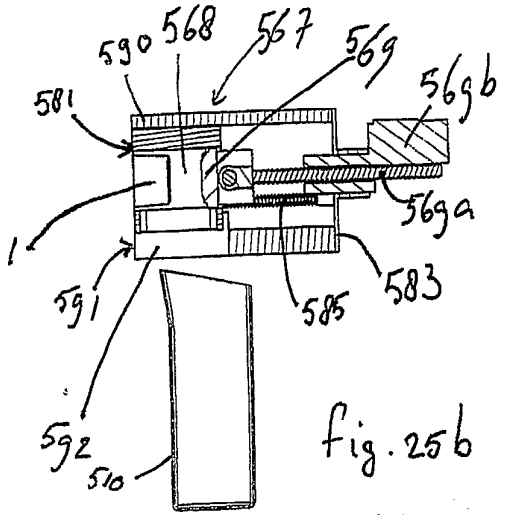


fig. 25b

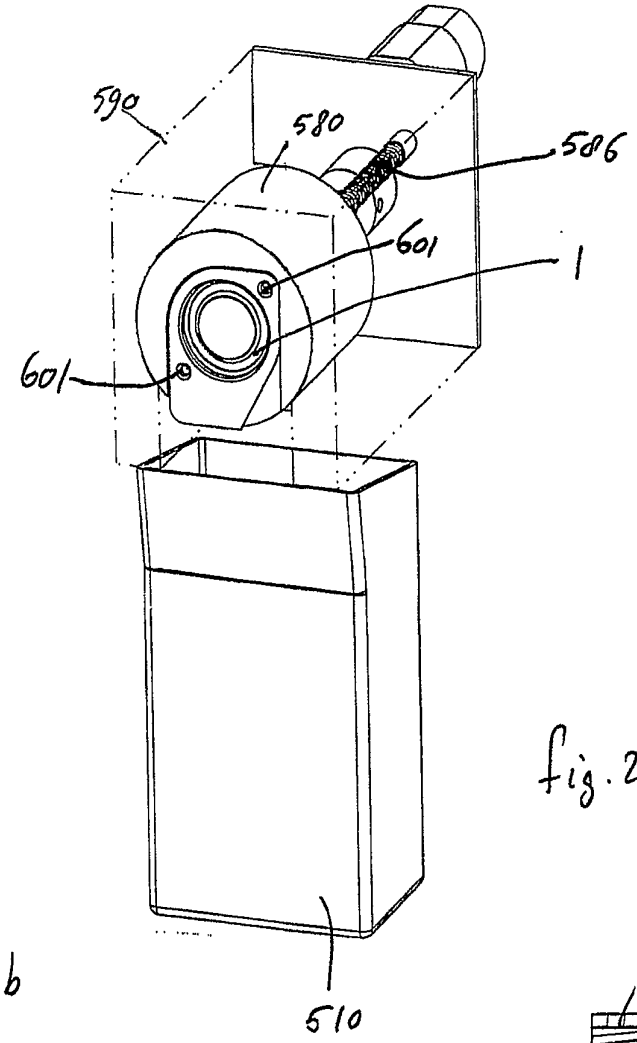


fig. 26a

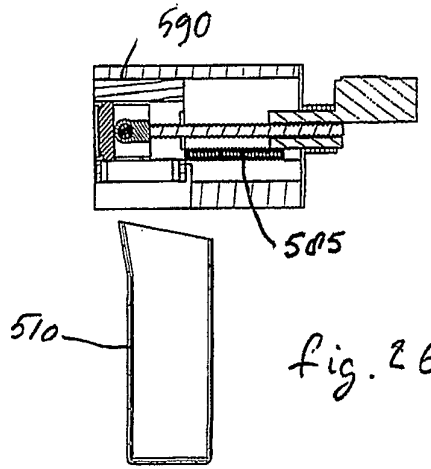


fig. 26b

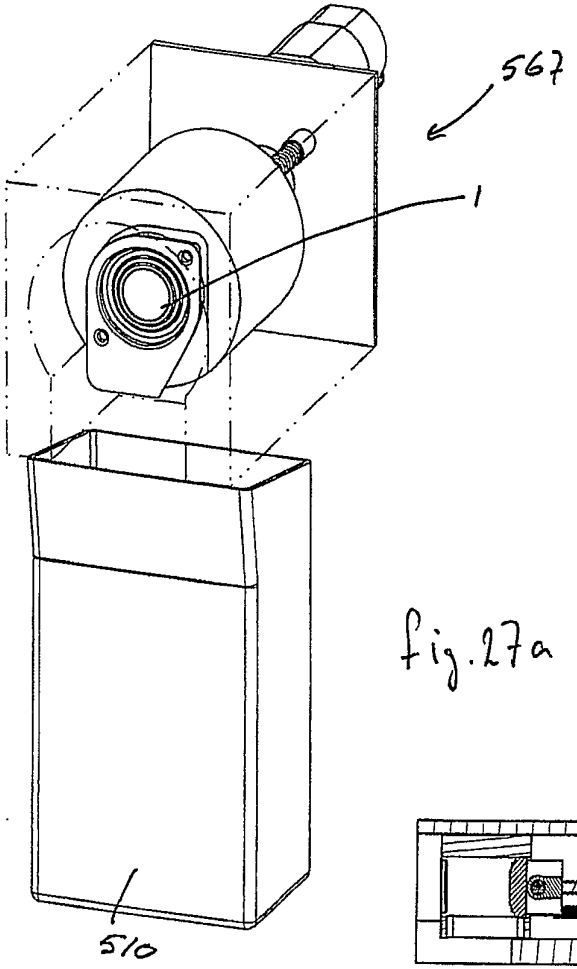


fig. 27a

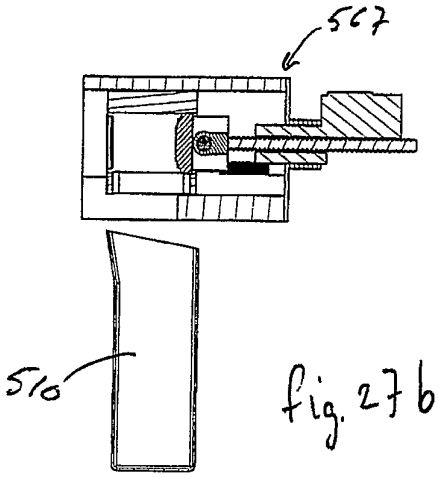


fig. 27b

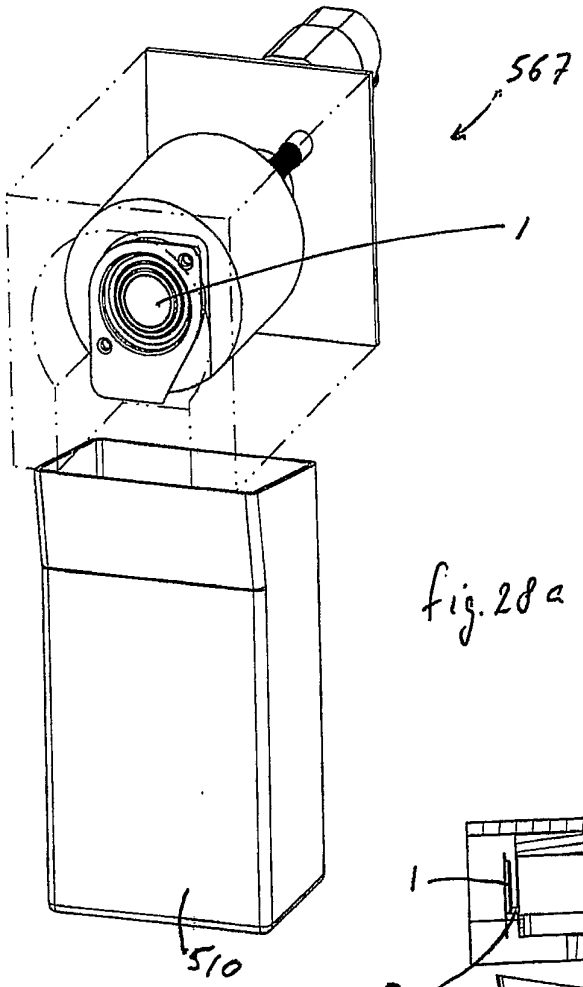


fig. 28a

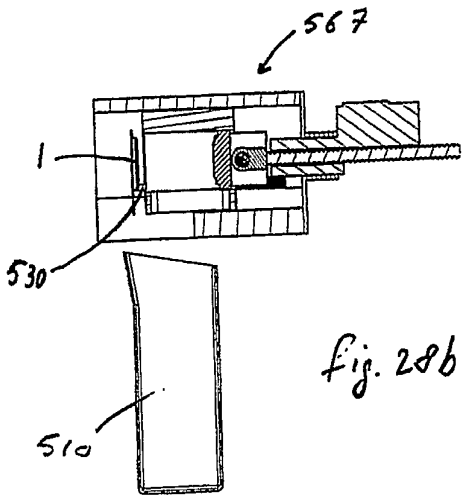


fig. 28b

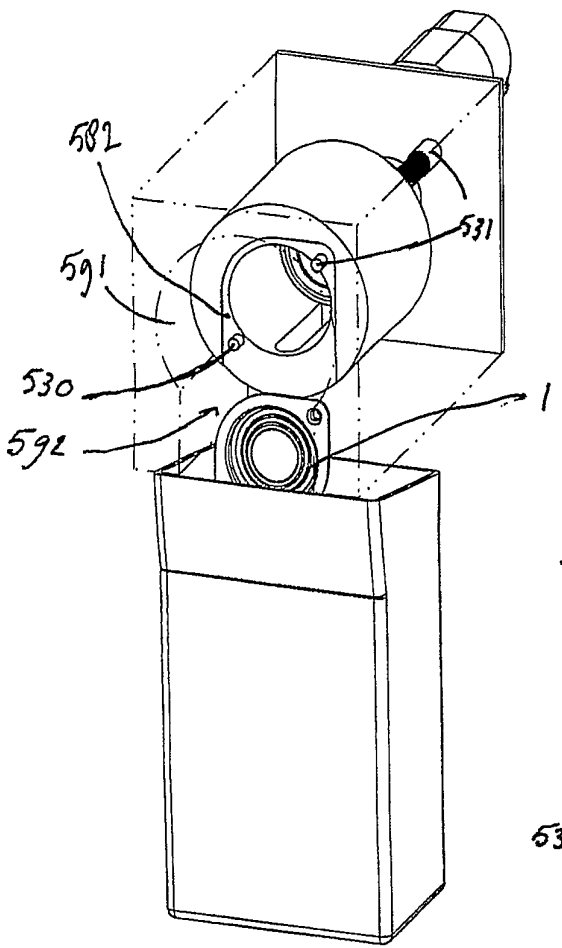


fig. 29a

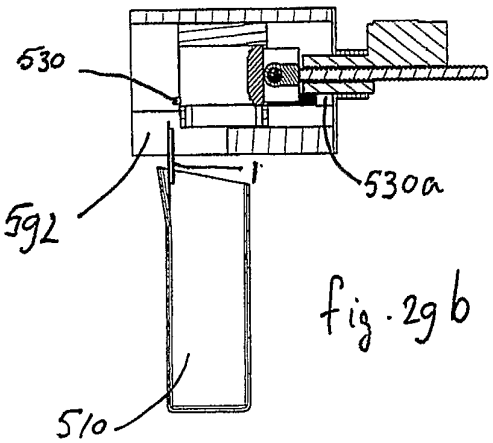


fig. 29b

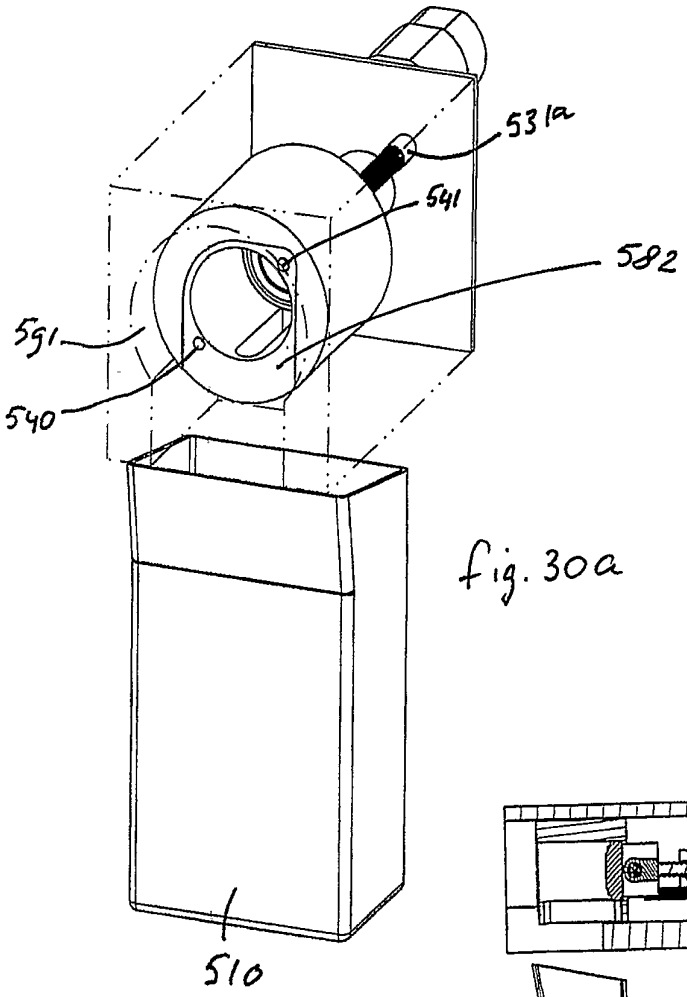


fig. 30a

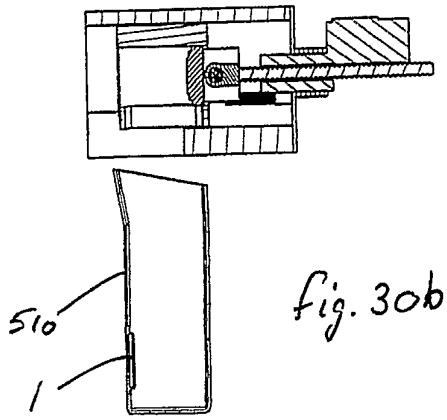


fig. 30b

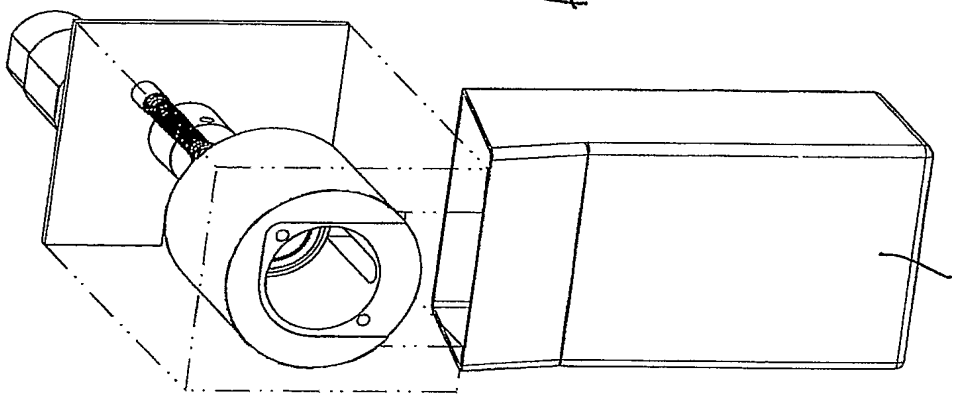


fig.31a

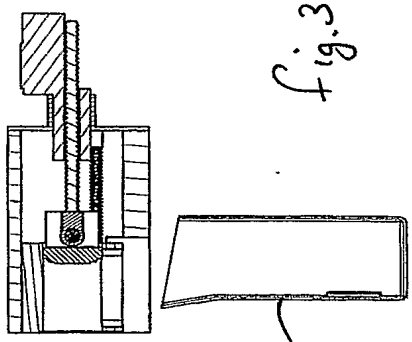


fig.31b

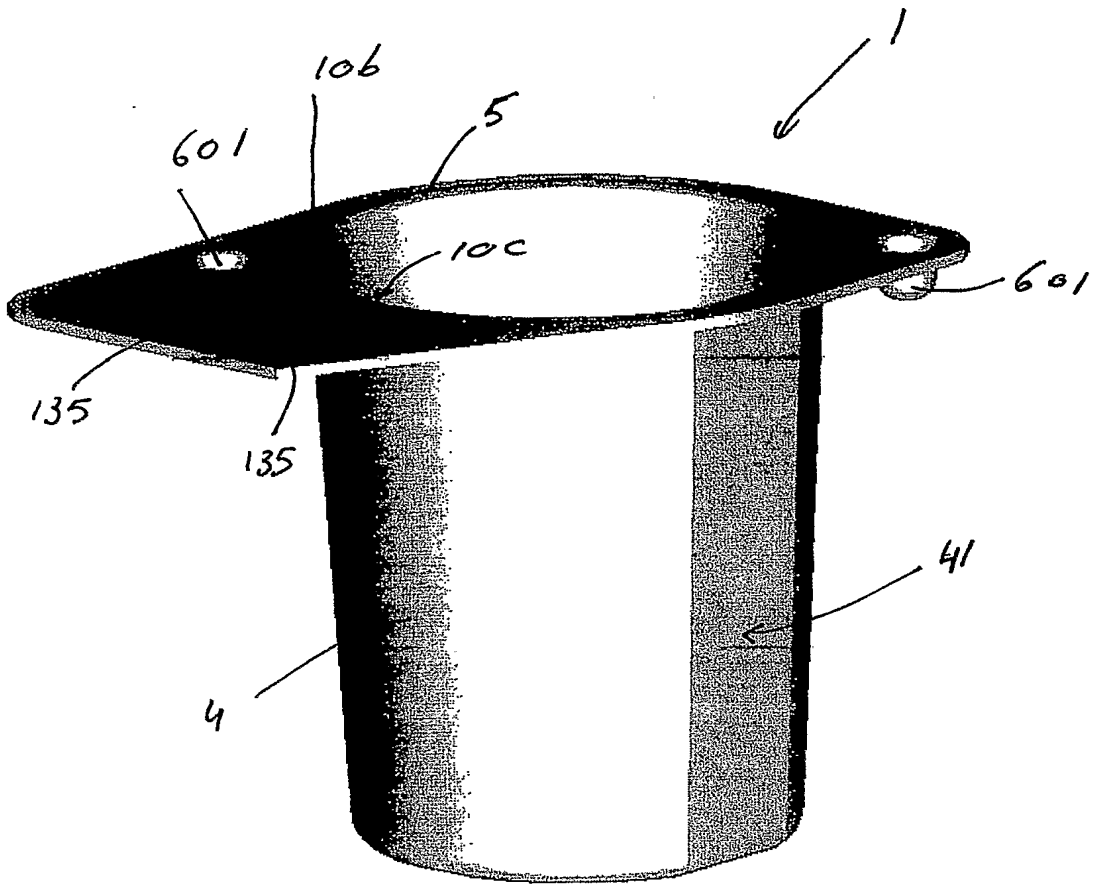


Fig. 32

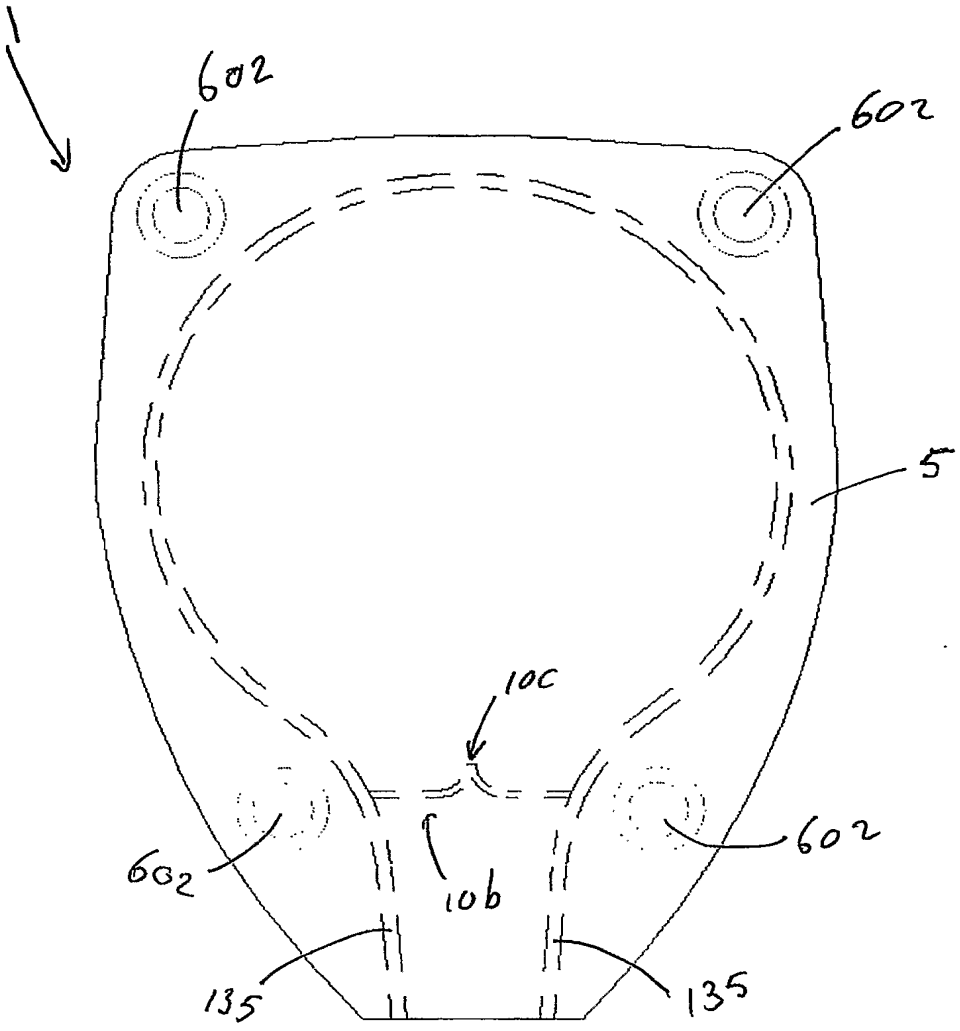


Fig. 33

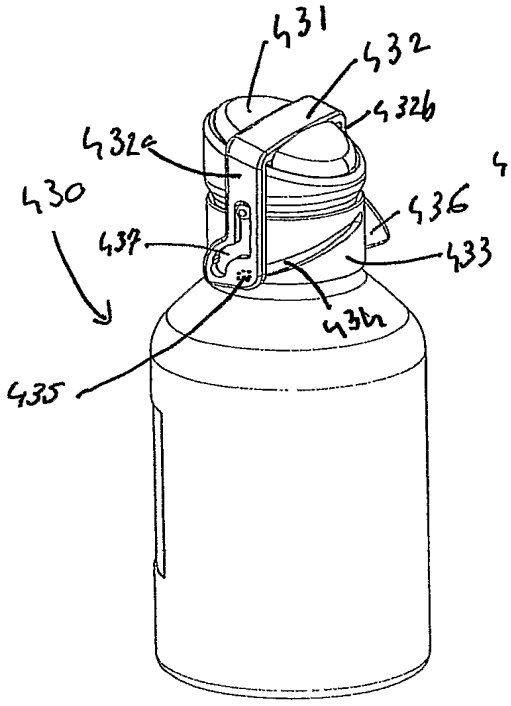


Fig. 34a

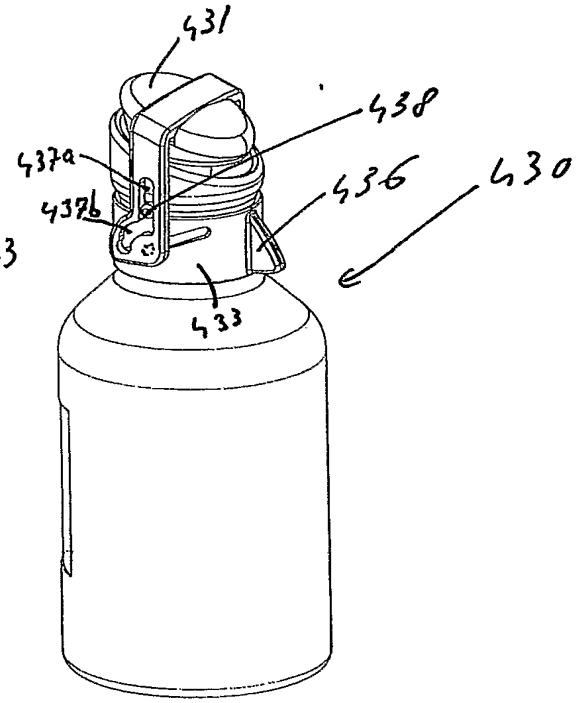


Fig. 34b

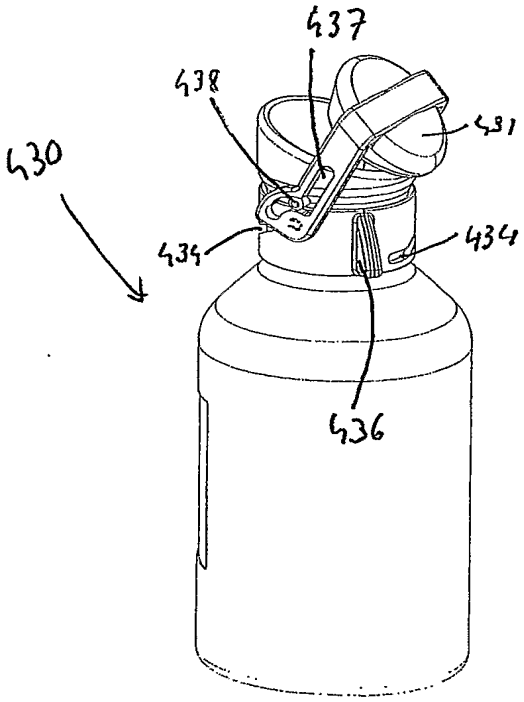


Fig. 34c

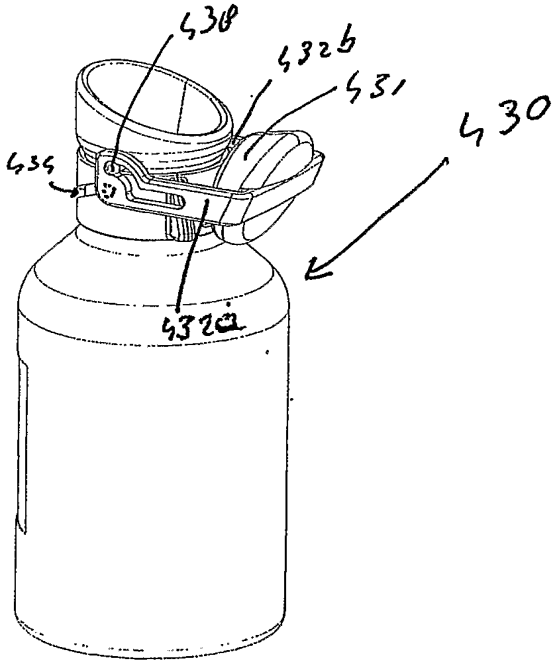


Fig. 34d

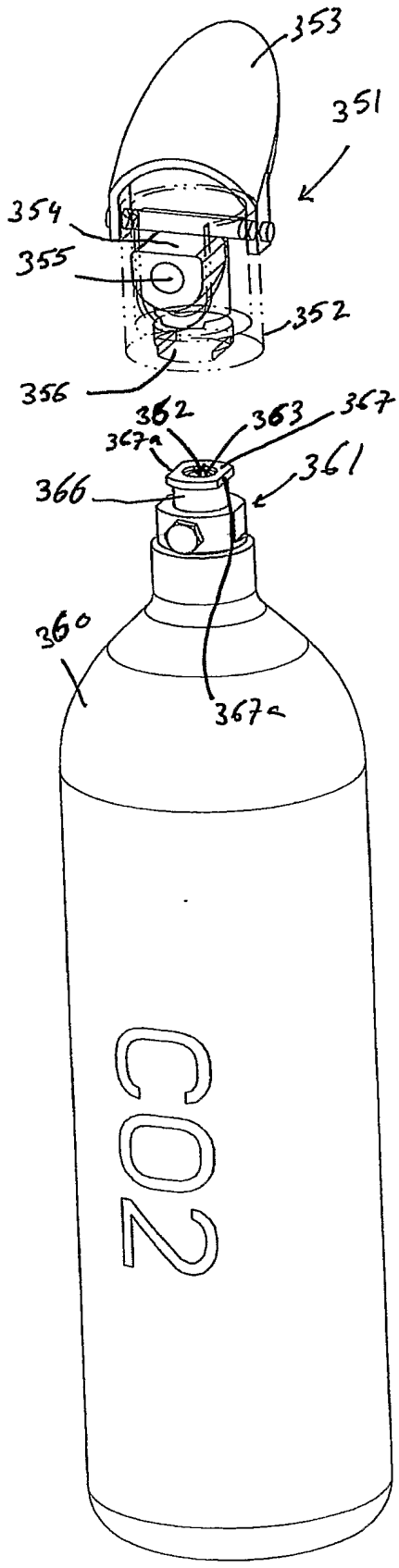


Fig.35a

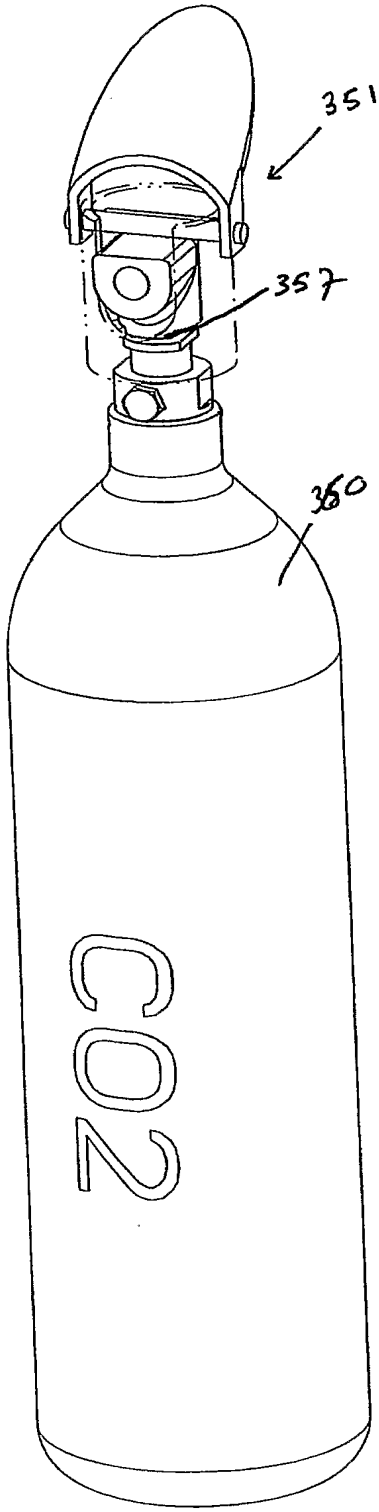


Fig.35b

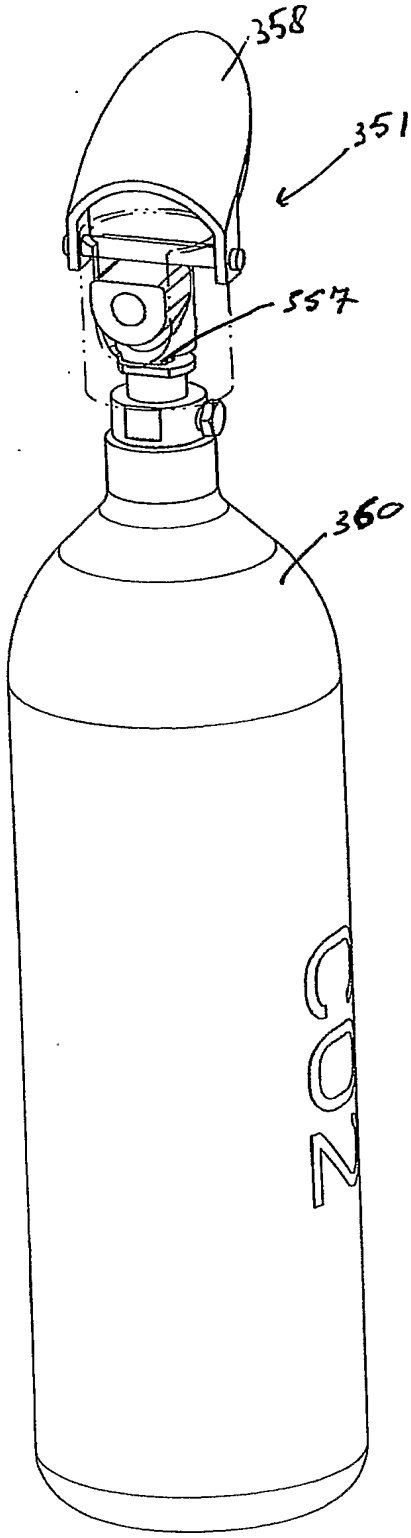


Fig.35c

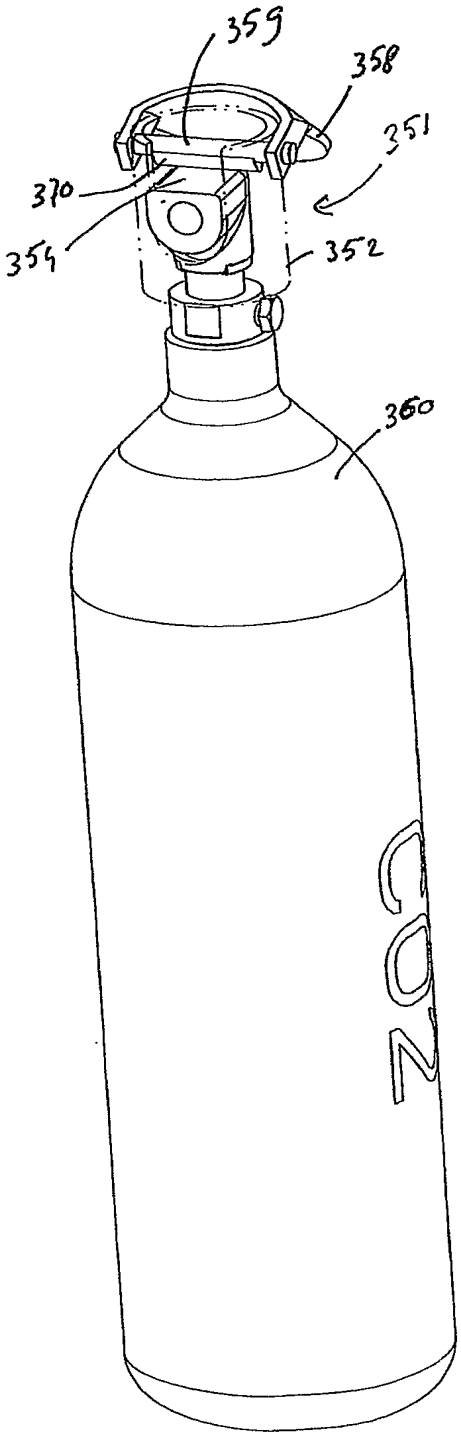


Fig. 35d

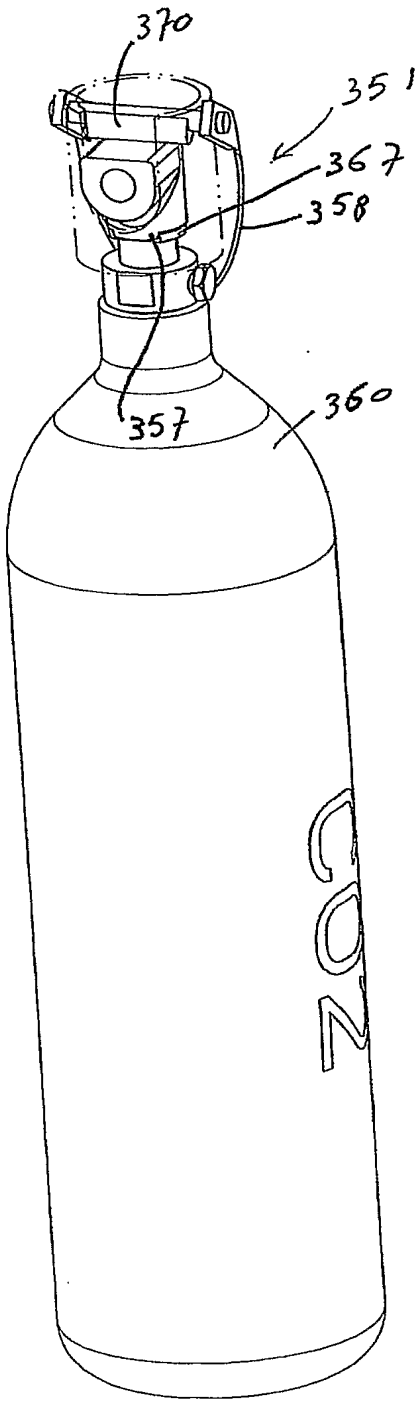


Fig. 35e

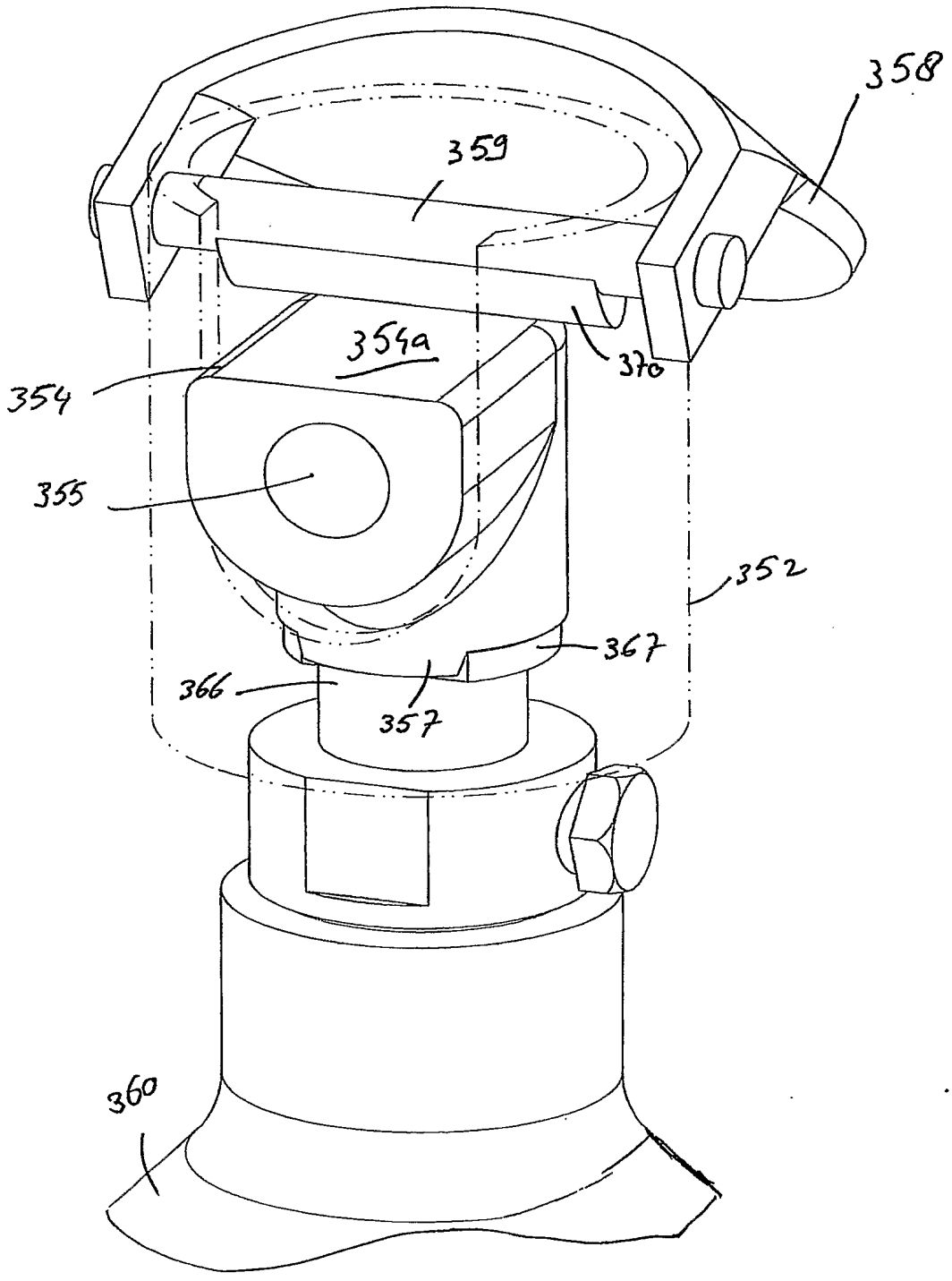


Fig.36